PB89-219224

Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County New Jersey, July 11, 1988. Third Remedial Action

(U.S.) Environmental Protection Agency, Washington, DC

11 Jul 88

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EPA/ROD/R02-88/074
July 1988

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EPA

Superfund Record of Decision:

Lipari Landfill, NJ

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16. Abstract (Limit: 200 words)

The Lipari Landfill site is a municipal and industrial waste landfill in Mantua Township, Gloucester County, New Jersey. The landfill consists of an "onsite" and an "offsite" portion. The onsite portion is a formerly active landfilling area that consists of a slurry wall/synthetic membrane containment system. This portion was addressed in a previous remedial action. A separate previous remedial action focused on flushing water- transportable contaminants from within the containment system. This remedial action addresses the offsite portion of the site which is the area outside of the encapsulation system consisting of agricultural and residential areas that include several lakes, streams, and parks. The site is bordered by the Zee Orchard on the north and west, and a housing development on the northeast. The site property was purchased by Mr. Nicholas Lipari in 1958 and was used until 1971 for excavation of sand and gravel and landfilling of municipal and household wastes, liquid and semi-solid chemical wastes, and other industrial wastes. Offsite investigations indicate that lakes, streams, and marshland in the area surrounding the site have been impacted by contaminant migration from the landfill. The primary contaminants of concern affecting the ground water, surface water, sediments, soil and air are VOCs including benzene, toluene, and xylene, and metals including arsenic, chromium, and lead.
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Lipari Landfill, NJ
Third Remedial Action - Final
Contaminated Media: gw, sw, soil, sediments
Key Contaminants: metals (arsenic, chromium, lead), VOCs (benzene, toluene, xylenes)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) None

20. Security Class (This Page) None

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22. Price

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ipari Landfill, NJ
Third Remedial Action - Final

16. ABSTRACT (continued)

The selected remedial action for the offsite areas includes: collection of the contaminated ground water/leachate, followed by onsite treatment and discharge to POTW; excavation of contaminated marsh soil, and dredging and dewatering contaminated sediments, followed by thermal treatment and offsite disposal as nonhazardous material; integration of offsite sampling with the onsite monitoring plan being developed to monitor the effectiveness of the onsite flushing action; and temporary remedial measures in the surrounding marshland, if necessary, to mitigate volatile emissions from leachate seepage areas. The estimated present worth cost for this remedial action is $21,000,000. O&M costs were not provided.

ATTENTION

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LIPARI LANDFILL SUPERFUND SITE

RECORD OF DECISION FOR THE OFF-SITE AREAS

JULY 11, 1988

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DECLARATION STATEMENT

RECORD OF DECISION

Lipari Landfill (Off-Site Areas)

SITE NAME AND LOCATION

Lipari Landfill, Mantua Township, Gloucester County, New Jersey

STATEMENT OF PURPOSE

This decision document presents the selected remedial actions for the off-site areas impacted by contaminant migration from the Lipari Landfill. These actions have been developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent applicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR part 300.

STATEMENT OF BASIS

I am basing my decision primarily on the following documents, which are contained in the administrative record, and that characterize the nature and extent of contamination and evaluate the relative merits of remedial alternatives for the Lipari Landfill off-site areas:

- On-Site Hydrogeological Remedial Investigation of Lipari Landfill, prepared by Camp Dresser & McKee, July 1985;
- On-Site Feasibility Study for Lipari Landfill, prepared by Camp Dresser & McKee, August 1985;
- Off-Site Remedial Investigation (Phase 1) for Lipari Landfill, prepared by Camp Dresser & McKee, June 1987;
- Off-Site Remedial Investigation (Phase 2) for Lipari Landfill, prepared by Camp Dresser & McKee, February 1988;
- Public Health Evaluation for Off-Site Remedial Investigation, Lipari Landfill, prepared by ICF/Clement Associates, June 1987;
- Off-Site Feasibility Study for Lipari Landfill, prepared by Camp Dresser & McKee, February 1988;
- Air Quality Investigation, Second Season Monitoring Results, Lipari Landfill, prepared by NUS Corporation, April 1988;
- Air Analyses for Lipari Landfill, May 27-June 5, 1986, prepared by Enviresponse, February 1987;

- Air Analyses for Lipari Landfill, September 11-30, 1986, prepared by Enviresponse, August 1987;
- TAGA Analyses of Spring Leachate, Air Vent and Surface Water Samples from Lipari Landfill, prepared by Enviresponse, August 1987;
- TAGA Analyses of Summer Leachate, Air Vent and Surface Water Samples from Lipari Landfill, prepared by Enviresponse, August 1987;
- Fall Air and Leachate Analyses for Lipari Landfill, October 17-November 14, 1987, prepared by Roy F. Weston, January 1988;
- Lipari Landfill Leachate Area Reconnaissance, prepared by NUS Corporation, March 1986;
- Air Sample Analyses for Lipari Landfill, prepared by Roy F. Weston, November 1985;
- Evaluation of Analytical Data from Park and Recreation Areas in Proximity to Lipari Landfill, prepared by NUS Corporation, September 1986;
- Review of Draft Final Off-Site Remedial Investigation Report for Lipari Landfill and Draft Final Public Health Evaluation for Off-Site Remedial Investigation, prepared by Environmental and Energy Consultants, February 1988;
- Health Assessment, Lipari Landfill, prepared by Agency for Toxic Substances and Disease Registry (ATSDR), October 1985;
- Health Assessment, Lipari Landfill, prepared by ATSDR, October 1986;
- Park and Recreational Area Health Assessment, prepared by ATSDR, October 1986;
- Health Consultation on July 1986 Private Well Analytical Data, Lipari Landfill, prepared by ATSDR, August 1987;
- Arsenic and Lead Health Consultation, Lipari Landfill, prepared by ATSDR, February 1988;
- Air Monitoring Data Analysis; Health Consultation, Lipari Landfill, prepared by ATSDR, March 1988;
- ERT Analytical Report for Lipari Landfill Sampling Effort of March 15 and 16, 1988, prepared by ERT, May 1988;

- Proposed Remedial Action Plan for Off-Site Lipari Landfill Areas, March 1988;
- The attached Decision Summary for the Lipari Landfill Off-Site Areas;
- The attached Responsiveness Summary, which addresses public comments received; and
- Staff summaries and recommendations;

DESCRIPTION OF SELECTED REMEDY

The remedial actions identified in this document represent a final solution for the Lipari Landfill site. The actions address those areas outside of the existing containment system which have been impacted by contaminant migration from the landfill. Previous Records of Decision, signed in 1982 and 1985, provided for the installation of a containment system around Lipari Landfill to mitigate the off-site migration of landfill contaminants, and the flushing of water-transportable contaminants from within the containment system.

Contamination attributable to the Lipari Landfill has been detected in the ground water, surface water, soils, lake and stream sediments, and the air in the vicinity of the landfill. The remedial actions to address this off-site contamination include the following components:

- Collection of ground water/leachate in the Cohansey and Kirkwood aquifers, followed by on-site treatment and discharge to a publicly owned treatment works;
- Excavation of contaminated soils in the Chestnut Branch marsh, followed by thermal treatment to remove organic contaminants and placement as a non-hazardous material;
- Dredging and dewatering of contaminated sediments in Alcyon Lake, followed by thermal treatment to remove organic contaminants and placement as a non-hazardous material;
- Dredging and dewatering of contaminated sediments in Rabbit Run and Chestnut Branch stream, followed by thermal treatment to remove organic contaminants and placement as an non-hazardous material;
- Temporary measures, if necessary, to reduce volatile emissions from leachate seepage areas in the Chestnut Branch marsh; and
- Integration of sampling in the off-site areas with the on-site monitoring plan being developed to monitor the effectiveness of the on-site flushing action.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, I have determined that the selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate, and is cost-effective. Futhermore, this remedy satisfies the preference for treatment that reduces toxicity, mobility or volume as a principal element. Finally, I have determined that this remedy utilizes permanent solutions and alternate treatment technologies to the maximum extent practicable.

The State of New Jersey has been consulted and agrees with the selected remedy.

July 11, 1988
Date

Christopher J. Daggett
Regional Administrator

I concur with the selected remedy for the Lipari Landfill site.

July 11, 1988
Date

Winston J. Porter
Assistant Administrator

DECISION SUMMARY

Lipari Landfill (Off-Site Areas)

SITE DESCRIPTION

The "off-site" Lipari Landfill areas are defined as those geographical areas outside of the landfill's existing slurry wall/ synthetic membrane encapsulation system. This system, referred to as the "on-site" portion of the Lipari Landfill, was constructed in 1983-84 to segregate those areas of formerly active landfilling from the surrounding environment. The off-site areas encompass a mix of agricultural and residential properties located in Mantua Township and the Borough of Pitman in Gloucester County, New Jersey (Figure 1). The off-site areas include the drainage basin east-northeast of the landfill consisting of Alcyon Lake, the Chestnut Branch marsh and Chestnut Branch stream, Rabbit Run, Girl Scout Branch, Lost Lake Run and three public parks -- Alcyon Park, Betty Park and Hollywood Dell Park.

The landfill borders the off-site area and is approximately 1500 feet north of U.S. Route 322 and 1.5 miles west of Glassboro State College. Northeast of the site and immediately east of Chestnut Branch stream is a housing development of single family homes. The Zee Orchard comprises most of the area north and west of the landfill.

It should be noted that both the "on-site" portion of the Lipari Landfill and the "off-site" areas impacted by contamination from the landfill are considered part of the site as defined by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Surface Waters

Several drainage systems occur in the area as shown in Figure 1, General Area Plan. The main drainage system is Chestnut Branch, with headwaters south of the landfill area. After flowing past the northeastern border of the site, Chestnut Branch discharges into Alcyon Lake approximately 1,500 feet north of the landfill. Rabbit Run, a small tributary of Chestnut Branch, derives its headwater flow from a small spring located adjacent to the landfill. This stream flows for approximately 1200 feet along the full length of the northwestern edge of the landfill before it discharges into Chestnut Branch just north of the site. Two other small streams of interest in the study area are Lost Lake Run and Girl Scout Branch. Lost Lake Run originates northeast of the Lipari Landfill within the residential area and discharges into Chestnut Branch directly east of the landfill. Girl Scout Branch originates northwest of the landfill and discharges into Alcyon Lake north of the Lipari site. These streams are important because they serve as a basis of comparison involving areas not impacted by the landfill.

Alycon Lake is a man-made lake fed by Chestnut Branch and Girl Scout Branch. It is estimated that the lake has a surface area of 18.5 acres, a maximum depth of 6.4 feet, an average depth of 3.4 feet, a volume of 2,740,000 cubic feet, and about 4,800 feet of shoreline.

It has been reported that the lake's natural recharge, (in addition to Chestnut Branch and Girl Scout Branch), originates from artesian springs in the lake bottom. The springs have been gradually impeded because of deposition of silt and organic overburden resulting in the reduction of the lake's depth. The geological origin of these springs is the Kirkwood aquifer.

Alcyon Lake has been closely associated with the history of the Borough of Pitman since its development in the 1890s. The lake was a public resource used for recreational activities until 1958 when recreational usage was first restricted because of bacterial contamination.

Chestnut Branch Marsh

The marsh area located adjacent to the Lipari Landfill has been impacted by contaminant migration from the landfill. It is bordered on the north by Rabbit Run, and to the east by Chestnut Branch stream. The marsh itself is a typical riparian environment characterized by a seasonally high water table close to the soil surface, standing water, and dense vegetation. Occasional flooding by Chestnut Branch stream, as well as yearly decay of vegetation have resulted in a layer of organic material on top of the native sandy soils. Several areas adjacent to leachate seeps in the marsh are characterized by large dead trees and sparse vegetation, leading to the conclusion that vegetation in these areas has been stressed because of contaminants in the soil and ground water. It has been estimated that at least 30,000 cubic yards of marsh soils have been impacted by contaminant migration. A description of the affected areas is contained on page 8 under the section titled "Phase III Off-Site Remedial Investigation". Access to the marsh has been restricted by fences installed in August 1983.

Public Parks

Three public parks border Chestnut Branch and Alcyon Lake -- Betty Park, Alcyon Park, and Hollywood Dell Park. Betty Park on the east bank and Alcyon Park on the west bank border on about 2,400 feet of Alcyon Lake shoreline. Hollywood Dell Park is at the northern most end of the lake, and is directly separated from the lake shoreline by a spillway (flood control dam) and West Holly Avenue. Alcyon Park contains picnic areas and a small recreation area for children. Hollywood Dell Park contains picnic areas, a soccer field, a baseball diamond, and a small recreation area for children. Historically, these parks have been extensively used.

Residential Community

The residential community of Pitman -- particularly the homes along Howard Avenue, Lake Avenue, Lakeside Avenue, and Lakeview Avenue -- lies within a few hundred feet east of the Lipari Landfill and Alcyon Lake. Complaints from local residents concerning irritating odors and nausea led to the closing of the landfill in 1971. Since the construction of the containment system in 1983-84, odors have been greatly reduced but not eliminated. Public access to Chestnut Branch, the marsh area, and Alcyon Lake is restricted by fencing and/or warning signs.

LIPARI LANDFILL SITE HISTORY

The property was purchased by Nicholas Lipari in 1958 for use as a sand and gravel pit. This type of land use also made the property profitable for landfilling subsequent to excavation of the sand and gravel. As sand and gravel were removed, Mr. Lipari accepted solid and liquid wastes for disposal. Approximately six acres of the site were used for these operations. It is documented that these excavations were in the western portion of the 15-acre parcel as shown in Figure 2, Lipari Landfill Site. The disposal history to be discussed below is summarized in Table 2, Chronological Summary of Disposal and Remediation History.

The two business operations (excavation and landfilling) were integrated by backfilling the excavated portions of the land with municipal and household wastes, liquid and semi-solid chemical wastes, and other industrial wastes. Between 1958 and 1971, liquid as well as semi-solid chemical wastes, and other industrial waste materials were accepted and dumped at the landfill. Solid wastes were disposed of until May 1971 when the site was closed by the New Jersey Solid Waste Administration (NJSWA). On Mr. Lipari's own initiative, liquid wastes were no longer landfilled after 1969 because of the concern about continued fire and explosion hazards. At least one explosion and two fires had occurred up to that time.

The exact nature and quantity of wastes received at the landfill are not known since detailed records were not maintained. The estimates based on parties known to have used the landfill indicate that 12,000 cubic yards of industrial solid wastes and more than 3 million gallons of liquid wastes were buried. It is reported that liquids were emptied from salvageable containers and that only unsalvageable drums were buried without first draining their contents. The wastes that were reported to have been dumped at the landfill included cleaning solvents, phenol or amine wastes and residues, and resins and ester press cakes. Generally, household refuse was disposed into trenches, followed by disposal of the liquid chemical waste. Other chemical wastes in 55-gallon drums were buried in trenches in the landfill.

In 1970, the New Jersey Department of Health (NJDOH) observed leachate seeping out of the landfill along the escarpment east of the site and discharging into Chestnut Branch and the adjoining marsh area. Leachate seeps were visible along the east and northeast slopes. They were brown and viscous in appearance and had a pungent irritating odor that was noticeable to area residents, particularly those residing along Howard Avenue. The landfill was closed in May 1971 by the NJSWA with the impetus of an affidavit, signed by local residents, that complained of intolerable odors, headaches, nausea, and the residents' inability to breathe.

In July 1971, the New Jersey Department of Environmental Protection (NJDEP) notified Mr. Lipari to correct the situation. Based on Mr. Lipari's consultation with engineers, he constructed surface water runoff diversions, regraded areas, and spread fresh dirt and lime to mitigate the problem; however, the effort was not effective. The NJDEP filed suit in 1972 against Nicholas Lipari for violation of the New Jersey Water Quality Act (NJSA 58:1023.1 et seq).

Numerous investigators subsequently collected samples of the contaminated ground water beneath the Lipari Landfill site. Attachment A, Leachate Characteristics of Lipari Landfill Samples, shows the contaminants and maximum concentrations measured in samples of ground water collected from within the landfill's encapsulation system up to 1985. The data provided in the attachment were used in the development of the On-site Feasibility Study (CDM, 1985). To date, a total of 74 organic contaminants and 13 inorganic contaminants have been found in the ground water and soils of the landfill.

History of Off-Site Areas

The off-site areas have been the subject of investigations by the Environmental Protection Agency (EPA) and others. These studies have documented sources of environmental degration. A discussion of such sources in addition to the Lipari Landfill is presented below. This section is then followed by a detailed discussion (Phase III Off-site Remedial Investigation) of the impacts of the Lipari Landfill on ground water, surface water, soils, sediment and air in the vicinity of the site.

In the mid-1950s, prior to operation of the Lipari Landfill, Alcyon Lake began to show physical signs of an existing public health problem and a deteriorating biotic environment. The Gloucester County Planning Department (GCPD, 1980) cited four primary reasons for the deterioration of Alcyon Lake during its early history.

' An increasing number of septic tank systems were installed within the lake's drainage area.

' Increased urban development and associated increases in storm water urban runoff discharges into Alcyon Lake and tributary streams by way of direct drainage inlets.

' Marginally effective sewerage collection and treatment facilities in the Boroughs of Pitman and Glassboro increasingly contributed fecal matter and bacteria into Alcyon Lake.

' Sedimentation resulting from urban and agricultural development activities sealed the natural springs in the bottom of the lake decreasing the turnover rate of fresh water.

Storm sewer outfalls that discharge directly into Alcyon Lake and its tributaries have contributed to the observed deterioration of the lake. The incorporation of the Borough of Pitman's sewage flow into the Gloucester County Utilities Authority (GCUA) wastewater treatment plant in the 1970s and subsequent construction of the Gloucester County sanitary sewer trunkline east of Chestnut Branch has helped to alleviate pollution from septic tanks. However, the extent of the present problem attributable to the abandoned septic tanks is unknown. The remedial investigation findings supported previous findings indicating that water quality in Alcyon Lake has deteriorated, in part, due to bacterial input. Current bacterial concentrations in the lake exceed water quality standards.

The existing bacterial contamination led Gloucester County to close Alcyon Lake to swimming in 1958.

The first documented point source of pollution to Alcyon Lake was due to the Borough of Glassboro sewerage treatment plant. A series of malfunctions between 1958 and 1972 caused the discharge of raw effluent that flowed down Chestnut Branch and into Alcyon Lake. The Gloucester County Sewerage Authority (now known as the Gloucester County Utilities Authority) incorporated the Glassboro system in 1972 and effectively eliminated these discharges (GCPD, 1980). The Borough of Pitman sewerage system lift station also experienced mechanical malfunctions and storm-related overloadings, causing the facility to activate the overflow mechanism and discharge raw effluent directly into Alcyon Lake. These problems were corrected by the Borough of Pitman in 1977, although 50-year storm events have occasionally resulted in incidental overflow from the lift station (GCPD, 1980). Further land development in the area brought additional sources of degradation.

In 1980, Gloucester County identified three major sources of pollutants contributing to the water quality deterioration of Alcyon Lake: urban storm water runoff, agricultural runoff, and the Lipari Landfill. The County recognized that increased development increased the pollutant burden of storm water runoff. Storm water runoff is a significant source of pollutants, including oil and grease, hydrocarbons, trace heavy metals, and micro-organisms. Storm water runoff from several hundred acres of the Boroughs of Pitman and Glassboro, including Collegetown Shopping Plaza and Glassboro State College, continues to discharge directly into Alcyon Lake and its tributaries through several drainage pipes.

The 1980 Gloucester County report also suggests that adverse water quality impacts on Alcyon Lake were further caused by the continued discharge of agricultural runoff from approximately 1,000 acres of active agricultural land treated with pesticides herbicides, and fungicides. However, specific studies to identify the mass loading of specific contaminants have not been undertaken. Consequently, the overall contribution and significance of these contaminants cannot be quantified.

History of Investigations

Various State, local, and municipal investigations and studies have taken place over the years, some of which have proved valuable in providing background information. The investigations performed prior to the studies to determine the extent and nature of the contamination in the Lipari Landfill off-site areas are summarized in Table 1, History of Investigations. A detailed discussion on these investigations is given in the Off-Site Lipari Landfill Remedial Investigation (Phase 1) Report (CDM, 1987).

History of Remedial Actions

Remedial actions have taken place both on-site at the Lipari Landfill, as well as off-site in the immediate vicinity of the landfill. On-site actions involved the construction of the containment system as previously described. Off-site actions have included temporary measures, such as fence installation and posted signs to restrict public access to the marsh and Alcyon Lake. A summary of the remedial history is given in Table 2, Chronological Summary of Disposal and Remediation History. A discussion of the history is presented below.

Public Access Restricted

Previous and ongoing investigations confirmed that there was a potential risk to the public health and environment associated with the Lipari Landfill. Action was taken under the authority of Section 104(c) of the Comprehensive Environmental Response, Compensation and Liability Act. In July 1982, an 8-foot high, chain-link-plus-barbed-wire fence was constructed around the main landfill site to restrict public access. In August 1983, a second chain link fence was installed along Chestnut Branch between the houses on Howard Avenue and the area east of Chestnut Branch to restrict public access to the marsh area.

Phase I Remedial Investigations

R.E. Wright (1981) evaluated several remedial alternatives intended as interim action until a comprehensive long-term solution could be developed. Radian Corporation (1982), at the request of EPA Region II, reviewed the environmental impacts associated with nine proposed Phase I remedial action alternatives for the on-site portion of the Lipari Landfill study area. The preferred alternative consisted of a fully encompassing 360-degree slurry wall with an impervious cap over a 16-acre area, with final treatment of the contaminated ground water within the encapsulation system at a pubicly owned treatment plant. EPA approved this preferred alternative for the on-site Lipari Landfill in a Record of Decision (ROD), signed on August 3, 1982, and commenced construction in the Fall of 1983. This remedial measure, presently referred to as Phase I, was designed to diminish the flow of leachate and contaminated ground water from the landfill. An estimated reduction of 95 percent in the rate of ground water flow has been achieved as a result of the installation of the containment system.

Phase II On-Site Remediation

The Final Draft Remedial Investigation and Feasibility (RI/FS) for the On-Site Lipari Landfill became the basis for the selection of a permanent remedial alternative as discussed in the EPA ROD, dated September 30, 1985. The remedial alternative which was selected is commonly referred to as the "batch-flushing" alternative. The effectiveness of the on-site remedial action to be implemented directly affects the long-term success of any remedial action taken in the off-site areas. The on-site action involves the installation of extraction and injection wells within the encapsulation system to dewater and flush water-borne contaminants for treatment at an on-site facility. A formal agreement to discharge to the GCUA treatment facility for final treatment is under negotiation. A remedial design study is currently being performed to determine the design parameters, particularly those that will allow the batch-flushing effort to be completed within the desired time frame and to meet GCUA pretreatment standards. While there is the potential for contaminants to seep through the slurry wall during flushing, the September 30, 1985 ROD specified that this problem would be mitigated by the off-site remedial action (such as an off-site collection system) developed under the off-site RI/FS and that implementation of the batch-flushing alternative would not begin until such an off-site collection system was in place. The remedial actions being selected at this time include an off-site collection system as identified in the 1985 ROD.

Phase III Off-Site Remedial Investigation

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), EPA conducted a remedial investigation and feasibility study for the "off-site" areas affected by contaminant migration from the Lipari Landfill site. Field work for the RI began in February 1985 and was completed in February 1987. Contaminants found in the ground water, surface water, soils, lake and stream sediments, and in the air in the off-site Lipari areas are listed in Attachment B, which includes data from the sampling performed by EPA's Field Investigation Team (FIT) and Environmental Response Team (ERT).

The off-site RI report documents the presence of organic and inorganic contaminants attributable to the Lipari Landfill in the following off-site areas:

- Ground water in the Cohansey and Kirkwood aquifers;
- Soils in the Chestnut Branch marsh;
- Leachate seeps in the Chestnut Branch marsh;
- Air in the vicinity the Chestnut Branch marsh above the leachate seeps and in nearby residential areas;
- Surface water and sediments of Chestnut Branch stream;
- Surface water and sediments of Rabbit Run; and
- Surface water and sediments of Alcyon Lake.

Contamination attributable to the Lipari Landfill in the off-site areas is due to migration through all media: soil, water and air. A total of 63 of the 74 organic contaminants, and all 13 of the inorganic contaminants detected on-site have been detected in the off-site areas. Due to the large number of Lipari-associated contaminants in the off-site areas, 13 indicator chemicals were selected for detailed review during the remedial investigation to evaluate contaminant migration from the Lipari Landfill. Table 3 compares concentrations of the indicator chemicals found in the off-site soils, sediments and surface waters in areas impacted by contaminant migration from the site, to background areas not impacted by the site. This table demonstrates that elevated levels of indicator chemicals exist in the soils of Chestnut Branch marsh, the sediments and surface waters of Rabbit Run, Chestnut Branch stream, and Alcyon Lake. In addition, Lipari-related contaminants including bis(2-chloroethyl)ether, 1,2-dichloroethane, and benzene have been detected during residential air monitoring performed with EPA's Trace Atmospheric Gas Analyzer (TAGA) unit.

A listing of representative Lipari-related contaminants found in the Cohansey and Kirkwood aquifers, the leachate seeps in Chestnut Branch marsh, and in the ambient air above the marsh and in residential areas since the construction of the on-site containment system, is shown in Table 4. Attachments A and B contain more complete listings of on-site and off-site sampling results. Attachment C presents a qualitative analysis of the presence of Lipari-related contaminants in all of the on-site and off-site media.

More recent sampling utilizing lower detection limits than were available during the RI has shown the presence of bis(2-chloroethyl)ether in the sediments of Chestnut Branch stream (41 to 47 milligrams per killigram (ug/kg)), and in the sediments of Alcyon Lake (42 to 400 ug/kg). This sampling was undertaken by EPA's Environmental Response Team (EPA/ERT), to address concerns raised by the U.S. Department of the Interior's Fish and Wildlife Service involving the presence of Lipari related contaminants in aquatic habitats for which it is the natural resource trustee. The concerns were related to high detection limits associated with sediment sampling during the off-site RI field activities, especially with regard to BCEE and mercury. It is notable that, during the off-site RI sampling when lower detection limits were achieved (Rabbit Run SE-08), BCEE was detected in the sediments. The detection of the presence of BCEE in the sediments of Alcyon Lake and Chestnut Branch by EPA/ERT has provided natural resource trustees with additional information to assess the impacts to habitats under their responsibility. It has also further demonstrated the presence of Lipari contaminants in the off-site environment. A 21-day comment period was announced to receive comments from interested parties on the EPA/ERT sampling effort. No comments were received during that period, however, comments regarding the sampling procedures and the reasons for the sampling event were received the following week. A reply was provided to these comments.

The Cohansey aquifer to the east and northeast of the landfill in the Chestnut Branch marsh is directly in the path of local and regional ground water flow. It is likely that the presence of contaminants in this aquifer is largely attributable to seepage prior to construction of the containment system. A portion of this formation in the marsh was not encapsulated because of the limits of slurry wall construction relative to local geology, geography and water conditions. As a result, a reservoir of contaminants persists in the ground water and soils of Chestnut Branch marsh. The leachate seep areas show seasonal variation corresponding to fluctuations in the water table of the Cohansey aquifer. This seasonal activity leads to intermittent periods of leachate flow into Chestnut Branch stream. The variability in leachate flow, coupled with variations in meteorological conditions (temperature, wind, rain fall, solar radiation, atmospheric inversions), affect the rate of hazardous organic air-borne emissions from the Chestnut Branch marsh. The area refered to as "Zone 3" (Figure 3) is characterized as the area of highest air-borne emissions. Zone 3 also encompasses the portions of the marsh containing the majority of the leachate seeps. A complete listing of compounds detected in the soils of Chestnut Branch marsh, the leachate seeps, and in the air above the seeps, is shown in Attachment B.

The Kirkwood aquifer underlies the Kirkwood clay, a confining unit that separates it from the surficial Cohansey aquifer. The Kirkwood is characterized as a low-yield formation containing fine to very fine dark grey silty micaceous sand. The contamination that is present in the Kirkwood may be due to improperly sealed wells placed in the landfill during the late 1970s that acted as a conduit for contaminant migration, or from vertical migration from contaminants present in the overlying Cohansey formation through the Kirkwood clay. The Kirkwood clay is a continuous formation under the site which ranges in thickness from 9 to 16 feet. In the area of the Chestnut Branch marsh adjacent to the site, the Chestnut Branch stream has eroded the Cohansey sands and the upper portions of the Kirkwood clay. Alluvial material deposited by the stream is hydraulically connected with the Cohansey sands, and the Kirkwood sands. The Kirkwood clay thins out because of erosion along the south-to-north meander of the stream. Near the confluence of Rabbit Run and Chestnut Branch, the Kirkwood clay appears to be completely eroded. Geologic profiles of the local area are contained in Attachment D.

CONTAMINANTS PATHWAYS/RISKS

Due to local environmental conditions, including geography, geology, hydrology and meteorology, and the results of off-site studies, EPA has concluded that several contaminant migration pathways exist from the Lipari Landfill to various off-site areas.

The detection of indicator chemicals in the surface waters and sediments of Rabbit Run, Chestnut Branch stream, and Alcyon Lake indicates that overland transport of indicator chemicals from the marsh has occurred. Erosion and/or leaching of marsh soils, followed by surface water transport is a likely migration pathway. Direct flow of contaminated seepage from the bank adjacent to the landfill, followed by flow across the ground surface to Chestnut Branch stream has been observed. Rainstorms and flooding could accelerate both processes. Contaminants can also leach vertically and reach the ground water. Analysis of organic chemical volatilization from marsh soils, leachate seeps, and ambient air demonstrates that air transport of organic contaminants is another contaminant migration pathway.

The presence of indicator chemicals in the downgradient ground water of the Cohansey and Kirkwood aquifers indicates horizontal migration of contaminants in the ground water. The presence of a hydraulic gradient towards Chestnut Branch stream on either side of the stream indicates that the potential for contaminant migration beyond the stream is unlikely. The Cohansey and Kirkwood aquifers both discharge into Chestnut Branch stream and can transport contaminants into the stream.

RISKS

As described in the off-site RI report, 13 indicator chemicals were selected in accordance with the Superfund Public Health Evaluation Manual on the basis of toxicity, persistence, mobility and concentration. The list of indicator chemicals includes: benzene, bis(2-chloroethyl)ether, 1,2-dichloroethane, ethylbenzene, 4-methyl-2-pentanone, toluene, xylenes (total), arsenic, chromium, lead, mercury, nickel, and zinc.

For risk assessment purposes, individual contaminants were separated into two categories of chemical toxicity depending on whether they cause carcinogenic or non-carcinogenic effects. In the case of chemicals exhibiting carcinogenic effects exposures and associated risks are expressed in an exponential nomenclature; 1x10-4 (one in ten thousand), 10x10-7 (one in ten million) etc. EPA has used the range of 1x10-4 to 1x10-7 in evaluating risk assessment decisions. The level of 1x10-6, one in a million, has often been used by regulatory agencies as a benchmark.

The Public Health Evaluation (PHE) characterized the risk associated with exposure to off-site Lipari Landfill indicator chemicals. A summary of the exposure pathways and associated risks is shown in Table 5. A lifetime excess cancer risk greater than 1x10-6 (one in a million) was characterized for the following exposure pathways:

- Direct contact with soils in the leachate seep areas;
- Consumption of fish from Alcyon Lake; and
- Inhalation of ambient air in the Howard Avenue residential area.

The PHE concluded that long-term exposure to volatile organic emissions originating in the Chestnut Branch marsh would result in a potential human health threat. Increased lifetime cancer incidences associated with exposure to BCEE, benzene, and 1,2-dichloroethane were quantified and are presented in Table 5. Although these compounds were detected during residential air monitoring with the TAGA unit, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluation of the TAGA data concluded that the levels detected do not pose a current health threat.

As described in the RI report, contaminant migration persists in the leachate seeps that in turn migrate into the Chestnut Branch marsh, as well as into the air above the marsh and nearby residential areas, to Chestnut Branch stream, and to downstream receiving waters including Alcyon Lake. Studies have shown that that bis(2-chloroethyl)ether and mercury are present in the tissue of fish from the lake. The landfill and the marsh areas are fenced to restrict access. Alcyon Lake is closed to fishing, swimming, boating and other recreational activties. The lake and streams are not used as sources of potable water.

The Pitman municipal wells, as well as 11 non-potable residential wells, have been sampled for priority pollutants, and most recently for Target Compound List (TCL) contaminants. The water samples have demonstrated that contaminants from the Lipari Landfill have not migrated into any local wells. These findings are consistent with local geological and hydrogeological conditions which indicate that contamination is limited to the Cohansey and upper portions of the Kirkwood aquifer. Futhermore, the Kirkwood aquifer flows upwards into the Chestnut Branch stream in the vicinity of the Lipari Landfill, while the Cohansey drains directly into the stream. Therefore, ground water contaminant migration is intercepted at the stream. This factor, coupled with the depth and location of the residential wells (Mount Laurel, approximately 150 feet deep) and the Pitman municipal wells (Potomac-Raritan-Magothy, approximately 550 feet deep) and the presence of several confining layers makes the possibility of the introduction of Lipari contaminants to either well system extremely remote.

ENFORCEMENT ACTIVITIES

On September 10, 1985, the United States filed a complaint in the District Court for the District of New Jersey against the Rohm and Haas Company, Inc., Marvin Jonas, Inc., CBS Records, Inc., Owens-Illinois, Inc., CENCO, Inc., Almo, Inc., and Manor Health Care Corporation pursuant to Section 107(a) of CERCLA, 42 U.S.C.)9607 (a), seeking recovery of costs incurred and to be incurred in remediating the Lipari Landfill, as well as declaratory relief pursuant to 2 U.S.C.)2201.

On January 29, 1986, the State of New Jersey filed a Complaint in Intervention in the suit seeking to recover State costs incurred and to be incurred in remediating the site.

In October 1986, negotiations for a partial settlement commenced with thirteen additional parties considered to be de minimis generators of waste disposed at the Lipari Landfill. Ten of the original thirteen de minimis parties remain at the conclusion of the negotiation process.

COMMUNITY RELATIONS ACTIVITIES

Numerous community relations activities have been on-going during the course of the off-site RI/FS for the Lipari site. A detailed 10-page Proposed Remedial Action Plan (PRAP) (Attachment E) was developed and distributed to over 300 interested citizens and potentially responsible parties. The PRAP was distributed on March 1, 1988 along with a notice for a Public Meeting to be held on March 29, 1988. The public comment period extended an additional 17 days beyond the public meeting to April 15, 1988. At the request of the Mayor of the Borough of Pitman, EPA held a public information meeting at Pitman Borough Hall on March 15, 1988. As discussed on page 9, a 21-day comment period was held to receive comments on the 1988 EPA/ERT off-site sampling program. While no comments were received during that period, later comments were received and a reply was sent.

The community has been actively involved in the issues related to the Lipari Landfill site for several years. The borough was the recipient of a Technical Assistance Grant (TAG) in January 1987 and hired a technical consultant in the Summer of 1987. The TAG program has facilitated communications between EPA and the community. Concerned citizens, local citizens, environmental groups and elected officials have all expressed the sentiment that they have felt involved in the decision making process for off-site remediation.

SCOPE AND ROLE OF REMEDIAL ACTIONS

The overall remediation of threats to public health and the environment posed by the Lipari Landfill has been undertaken by EPA in a three-phased approach. As discussed previously, the August 3, 1982 ROD (Phase I) selected a 360 degree slurry wall and impermeable cap to restrict contaminant migration from the site. This action provided substantial relief from noxious volatile emissions and the migration of contaminants into the marsh area, nearby streams and Alcyon Lake. The September 30, 1985 ROD (Phase II) addressed the permanent removal of contaminants from within the containment system through batch-flushing and on-site treatment of the flushwater. In addition, that ROD called for the collection of leachate outside of the containment system.

This ROD addresses Phase III, or those areas outside of the containment system where Lipari-related contaminants persist in the environment. The principal threats associated with these contaminants in the off-site areas include potential human health threats from long-term exposure to contaminants, and contaminants that are present in quantities that exceed environmental standards and guidelines. These are illustrated in Table 5, Risk Assessment and in Table 6, Chemical Specific ARARs.

Remedial actions to remove persistent contaminants from Chestnut Branch marsh, Rabbit Run, Chestnut Branch stream, and Alcyon Lake will eliminate these threats. The installation of a collection system in the marsh outside of the slurry wall will ensure that no existing contaminants or potential future contaminant migration during on-site flushing impacts the off-site areas.

Similarly, the active pumping and treatment of contaminants from the Kirkwood aquifer will remove existing contaminants, and any potential future contaminants. This action will restore the aquifer to ensure that environmental standards are met at discharge points of the Kirkwood ground water in Chestnut Branch stream and Alcyon Lake. Actions aimed at the collection of contaminated ground water/leachate will meet the intent of the Phase II ROD to coordinate off-site remedial actions with on-site remedial actions, "especially with regard to leachate treatment".

In summary, the remedial actions set forth in this Record of Decision represent the third phase of a coordinated effort to remove contaminants from the environment that are associated with the Lipari Landfill.

DESCRIPTION OF REMEDIAL ALTERNATIVES

This section describes the remedial alternatives that were developed, using suitable technologies, to meet the objectives of the NCP. These alternatives were developed by screening a wide range of technologies for their applicability to site-specific conditions including applicable or relevant and appropriate requirements (ARARs) and evaluating them for effectiveness, implementability, and cost.

ARARs

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with all applicable or relevant and appropriate Federal and State requirements for the hazardous substances, pollutants, or contaminants that are present and attributable to a site. In general, ARARs are promulgated to address chemical contaminants, specific locations (such as a marsh), or actions (such as thermal desorption). Chemical-specific ARARs can be applied to the RI results before any remedial alternatives are developed, while location- and action-specific ARARs relate to remedial alternatives and their implementation. As discussed in the Off-Site RI and FS, numerous chemical, location, and action-specific ARARs were evaluated for the off-site areas. The contaminated soils and sediments in the off-site areas are impacting the quality of water in contact with the soils of Chestnut Branch marsh, and the sediments of Rabbit Run, Chestnut Branch stream and Alcyon Lake. As such, cleanup of these areas is necessary to achieve water quality ARARs.

The same rationale applies to the marsh ground water collection system. However, no federal or state ARARs have yet been established for soils and sediments. As such, the guidelines applied to the soil and sediments include the following:

- Cleanup objectives developed by the NJDEP for soils under the Environmental Cleanup and Responsibility Act (ECRA);
- Health or risk based criteria; and
- Comparison to background levels.

The marsh soils, the leachate seep areas, and the sediments of Alcyon Lake, Rabbit Run and Chestnut Branch all contain contaminants that are also present in the surface waters at levels in violation of federal and state water quality standards and/or guidelines. The removal and treatment of the soils and sediments, coupled with the hydraulic isolation of the landfill via an off-site collection system will eliminate the soil/sediment/surface water interface as a contaminant pathway. The capture of seepage in the marsh, coupled with the interception of contaminated ground water in the Kirkwood aquifer will ensure that contaminants present in these areas will not migrate to the surface waters of Chestnut Branch and to downstream receiving waters.

In the vicinity of the Lipari Landfill, the Kirkwood aquifer has been characterized as discharging into Chestnut Branch stream from both sides of the stream. It is not utilized as a drinking water source in the local area, therefore, at a minimum, remediation of the aquifer will be to protect surface water quality. As such, surface water ARARs (Federal Water Quality Criteria under the Clean Water Act, Fresh Water 2-Non Trout under N.J. Surface Water Standards) are appropriate cleanup standards for the Kirkwood. Table 6 lists chemical specific ARARs under these statutes for contaminants detected in the Kirkwood aquifer. A more thorough discussion is contained in the section titled "Summary of the Comparative Analysis of Alternatives".

In addition to the chemical-specific ARARs, location-specific and action-specific ARARs exist for activities associated with the off-site remedial alternatives.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances solely because they are in particular locations. Location-specific ARARs that apply to the off-site Lipari areas include; Executive Order 11990 on Protection of Wetlands and Executive Order 11988 on Floodplain Management. EPA has sought input from other agencies (e.g. U.S. Fish and Wildlife, U.S. Army Corps) in developing remedial alternatives and restoration activities for the off-site areas. Input from these and other agencies will be included during remedial design to address the specific details of the integration of the requirements of these Executive Orders with respect to off-site wetlands and waterways.

The Fish and Wildlife Coordination Act of 1958 requires that an evaluation and wetlands assessment be undertaken for the off-site wetlands that will be impacted during remedial actions. Off-site studies have characterized the off-site wetlands areas, any futher evaluations and assessments that will assist in the cleanup and restoration efforts will be incorporated into the remedial design.

The site of the placement of treated material, the Alcyon Racetrack, is located in the Borough of Pitman. The downtown area of Pitman has been designated as an historic district. In addition, both the Chestnut Branch stream corrider and the abandoned racetrack may be considered sensitive for the presence of cultural resources under the National Historic Preservation Act. Studies to date have not indicated that any of the off-site areas are considered to be culturally sensitive areas, however, a Stage IA Survey will be performed on these areas during the design phase to futher evaluate cultural sensitivity.

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken to address hazardous wastes. These actions are triggered by particular remedial activities that are selected to accomplish a remedy. Since there are several actions to be taken in the off-site areas, a number of different requirements have been reviewed. The action-specific requirements do not in themselves determine the remedial alternative, rather they indicate how a selected alternative must be achieved.

During the development of the off-site remedial design, action-specific ARARs for dredging the streams and lake that will be evaluated include: Section 10 of the Rivers and Harbors Act and U.S. Army Corps of Engineers regulations. Action-specific regulations regarding treatment actions that will be utilized during remedial design include: RCRA regulations regarding temporary waste piles (staging areas during treatment) and New Jersey Administrative Code regulations for air emissions (off-gases from rotary kiln dryer).

A comprehensive list of candidate remedial technologies was compiled to characterize each technology and determine its applicability to the off-site Lipari areas. The remedial technology screening summary, which is included as Table 7, provides brief rationales as to why some of the technologies screened were included for or excluded from further consideration.

The technologies that were retained after the preliminary screening process were assembled in various combinations to form 19 general response actions for the off-site areas. These actions fall into 10 groups: no action, soil covering, excavation, dredging, on-site treatment, on-site disposal, off-site disposal, off-site collection systems, and ground water recovery and treatment. In addition, an interim measure to suppress volatile emissions originating in the Chestnut Branch marsh was developed.

From the 19 general response actions, the components of 24 alternatives and six disposal/placement options were developed and are presented below. In addition, alternative-specific variations involving one or more of the disposal/placement options and/or excavation options were developed.

Remedial Alternatives

The descriptions of the remedial alternatives are grouped and presented in the following manner:

Chestnut Branch Marsh Collection System: Alternatives 1-3

Chestnut Branch Marsh Soil Remediation: Alternatives 4-10

Alcyon Lake Remediation: Alternatives 11-12

Rabbit Run Remediation: Alternatives 13-14

Kirkwood Aquifer Collection System: Alternatives 15-16

Chestnut Branch Stream Remediation: Alternatives 17-18

Interim Action for Chestnut Branch Marsh: Alternative 19

ALTERNATIVE 1: WELLPOINTS WEST OF THE SEEPAGE FACE

Alternative 1 involves the installation of a wellpoint system (60-120 wells) in Chestnut Branch marsh between the seepage face and the containment system. This wellpoint network would function as an off-site collection system to capture any seepage resulting from the on-site flushing action. The collected seepage would be treated at the on-site treatment facility. This option would require extensive maintenance. Futhermore, up to 10 percent of the leachate may not be captured by the wellpoint system. The approximate locations of Alternatives 1, 2, and 3 are illustrated in Figure 4.

ALTERNATIVE 2a: DRAINAGE DITCH NEAR SEEPAGE FACE

Alternative 2a involves the installation of a French drain near the base of the leachate seepage face in Chestnut Branch marsh to collect any seepage from the on-site flushing action. The drain would capture essentially all of the leachate that may migrate through the slurry wall. This would ensure that any future contaminant migration would not affect the off-site areas. As with Alternative 1, the collected seepage would be treated at the on-site treatment facility. Excavated marsh soils would be handled either as a RCRA waste or treated to remove volatile organics and disposed of as a non-hazardous material.

ALTERNATIVE 2b: DRAINAGE DITCH NEAR SEEPAGE FACE WITH IMPERMEABLE COVER

Alternative 2b involves the same technology and steps as does Alternative 2a. Futhermore, this alternative would require the installation of an impermeable cap over the drain and portions of the surrounding marsh. This cap would reduce the amount of rain water infiltration into the trench as well as further reduce the possibility of volatile emissions from the marsh soils between the drain and the slurry wall. The disposal options for excavated soils are the same as for Alternative 2a. The reduction in rainwater infiltration would reduce long-term operation and maintenance costs associated with leachate collection and treatment.

ALTERNATIVE 3: WELLPOINTS EAST OF THE SEEPAGE FACE

Alternative 3 involves the installation of a wellpoint system in Chestnut Branch marsh between the seepage face and Chestnut Branch to collect any seepage from the on-site flushing action. As with Alternatives 1 and 2, the collected seepage would be treated at the on-site treatment facility. It is expected that this alternative will result in lower water levels in the marsh, resulting in a reduction in the amount of volatile emissions associated with the leachate seeps. This alternative is best suited for selection with a no action alternative for the marsh itself since the area between the wellpoints and the slurry wall would expect to be remediated through natural processes if no action were taken. It is anticipated that the process of natural degradation would take several years.

ALTERNATIVE 4: NO ACTION IN CHESTNUT BRANCH MARSH

Under the no action alternative, it is assumed that an off-site collection system would be implemented to meet the intent of the September 30, 1985 ROD. This alternative would rely on natural flushing and degradation of contaminants in the marsh over time. However, for several years, the marsh would continue as a source of contamination posing a risk to public health and the environment.

ALTERNATIVE 5: PERMEABLE COVER IN CHESTNUT BRANCH MARSH

Alternative 5 involves the removal of the vegetation in the marsh and placement of a permeable soil cover over all or a portion of the marsh soils. While this alternative will result in a reduction of public health risks associated with contaminants in the marsh soils and emissions from the soils, it would not reduce the amount of contamination present. The potential for contaminant migration and discharge into Chestnut Branch stream would continue to exist. The cover would consist of two to three feet of permeable sand or gravel over approximately 193,000 square feet of the marsh.

ALTERNATIVE 6: IMPERMEABLE COVER IN CHESTNUT BRANCH MARSH

Alternative 6 involves the same technical approach as Alternative 5. This alternative also would utilize a synthetic, impermeable cap on top of the soil cover. The presence of the cap would add an additional measure of safety with respect to the elimination of contaminant pathways (air emissions and contact with soils) that have been characterized as posing potential human health threats. As with Alternative 5, contaminants would persist in the underlying marsh soils and could continue to migrate to Chestnut Branch and impact local surface water quality.

ALTERNATIVE 7: TOTAL EXCAVATION OF THE CHESTNUT BRANCH MARSH

Alternative 7 involves the excavation of Chestnut Branch marsh soils to the top of the Kirkwood clay formation. The excavation activity in the marsh would involve dewatering the marsh area, clearing and grubbing of the vegetation, excavation, staging and disposal of the contaminated soil, and soil replacement, compaction and resoration of the marsh. Appropriate surface water and sedimentation control measures would be incorporated. Water from the dewatering operation would be pumped to the on-site treatment facility. A volume of approximately 71,500 cubic yards would be excavated from the marsh. The removed soil would then be disposed of in a new on-site RCRA facility (Option A) or transported for disposal to an off-site RCRA facility (Option B). Alternative 7 also contains a cost option to excavate approximately two feet of soil in Zones 1 and 2 of the marsh, while excavating approximately 10 feet of soil from Zone 3, the area of highest contamination. Organic contaminants have been detected in the surface soils of Zone 1 and 2 at lower concentrations than in Zone 3. Excavation and disposal of marsh soils would result in elimination of contaminant pathways associated with the marsh.

ALTERNATIVE 8: PARTIAL EXCAVATION OF CHESTNUT BRANCH MARSH

Partial excavation of Chestnut Branch marsh involves excavation of approximately 19,900 cubic yards of soil from Zone 3 within the marsh. This is the area characterized as the area of active leachate seeps and hazardous emissions. Contaminants present in the surface soils in other areas of the marsh may continue to migrate to surface waters. The disposal of the contaminanted soil would be via Disposal Option A or B. The activities associated with the implementation of this alternative are the same as those described for Alternative 7.

ALTERNATIVE 9a: TOTAL EXCAVATION OF CHESTNUT BRANCH MARSH, TREATMENT FOR ORGANICS, REPLACE SOILS IN THE MARSH.

Alternative 9a involves the complete excavation of marsh soils to the top of the Kirkwood clay, followed by treatment with a rotary kiln drier. This alternative includes the same activities associated with the implementation of Alternative 7 except that contaminated soils would be transported to a temporary storage area where they would be thermally treated with a rotary kiln drier to remove organics prior to their disposal. The staging area would comply with RCRA regulations that detail the design and construction of temporary waste storage areas. The rotary drier unit would be located in the staging area.

A rotary kiln drier operates at temperatures up to about 600°F. The material placed in such a unit is constantly turned over and mixed as the kiln rotates. The operating temperature will result in substantial removal of organic contaminants from the soil; however, metals are not expected to be significantly affected by this technology. The off-gases from this unit would be captured on carbon filters or a similar adsorbent, or be treated.

The treated soil would be placed back into the marsh and the marsh would be restored. However, due to the wet marsh environment, soils placed back in the marsh may continue to be a source of contaminant (metals) migration to nearby surface waters. This alternative also contains a cost option for limited excavation of Zones 1 and 2 and total excavation of Zone 3 similar to the one described in Alternative 7.

ALTERNATIVE 9b: TOTAL EXCAVATION OF CHESTNUT BRANCH MARSH, TREATMENT FOR ORGANICS, DISPOSAL OF SOILS AS A NON-HAZARDOUS MATERIAL

This alternative involves the same activities associated with the implementation of alternative 9a except that treated soils would then be disposed of as a non-hazardous material. This alternative also has a similar cost option for excavation to approximately two feet. Alternative 9b differs in that the treated soils may be classifiable as non-hazardous and be disposed in a suitable off-site location. In the FS, Alcyon Racetrack, two municipal landfills, and disposal on top of the Lipari Landfill, were evaluated for placement of the treated soil. Restoration actions would be undertaken at the marsh.

ALTERNATIVE 10a: PARTIAL EXCAVATION OF CHESTNUT BRANCH MARSH, TREATMENT FOR ORGANICS, REPLACE SOILS IN THE MARSH

Alternative 10a involves excavation of approximately 19,900 cubic yards of soils from Zone 3 in the marsh. This alternative utilizes the same technology and steps as Alternative 9a. Contaminants present in the other areas of the marsh could continue to migrate to local surface waters. Restoration actions would be undertaken for the marsh.

ALTERNATIVE 10b: PARTIAL EXCAVATION OF CHESTNUT BRANCH MARSH, TREATMENT FOR ORGANICS, DISPOSAL OF SOILS AS A NON-HAZARDOUS MATERIAL

Alternative 10b involves excavation and thermal treatment of approximately 19,900 cubic yards of soils from Zone 3 of the marsh and also includes a costing option for similar actions in Zones 1 and 2 to approximately two feet. This alternative utilizes the same technology and steps as Alternative 9b. Restoration actions would be undertaken for the marsh. Disposal of the sediments in a drier environment would minimize any potential migration of metals into local surface waters.

ALTERNATIVE 11: NO ACTION TO REMEDIATE ALCYON LAKE SEDIMENTS

Under the no action alternative, it is assumed that an off-site collection system would intercept contaminant migration to the sediments and surface waters of Alcyon Lake. Once upstream contaminant pathways were eliminated, in a relatively short period of time the contaminant concentrations in the water column would be expected to decline. However, contaminants present in the sediments would persist for an undetermined period of time. The potential for contaminants leaching from the sediments into the water column would continue.

ALTERNATIVE 12a: DREDGE AND DEWATER SEDIMENTS FROM ALCYON LAKE, DISPOSAL OF SEDIMENTS IN A RCRA FACILITY

Alternative 12a involves the hydraulic dredging of the sediments from Alcyon Lake, followed by dewatering with filter presses or similar equipment. The filter press water would be routed to the on-site treatment facility. Approximately 140,000 cubic yards of dredged material would be pumped from the lake directly to portable filter presses located near the shore. The water removed from the dredged material would be discharged to the on-site treatment facility. The final volume of the dewatered sediments is estimated to be 56,000 cubic yards. The dewatered sediments would then be placed in a new on-site RCRA facility (Option A) or transported to an off-site RCRA facility (Option B) for disposal. The activities involved in transportation and the disposal at either facility would be the same as in Alternative 7. This alternative would result in the removal of contaminated sediments, and the potential for contaminant leaching from the sediments into the lake waters would be eliminated.

ALTERNATIVE 12b: DREDGE AND DEWATER SEDIMENTS FROM ALCYON LAKE, TREATMENT FOR ORGANICS, DISPOSAL OF SOILS AS A NON-HAZARDOUS MATERIAL

This alternative involves the same activities associated with the dredging of sediments from Alcyon Lake as discussed in Alternative 12a, but includes thermal treatment of sediments to remove organic contaminants and disposal as a non-hazardous material. After dewatering, the sediments would be treated thermally with a rotary kiln drier to remove organic contaminants. The sediments may then be classifiable as non-hazardous and placed at a suitable off-site location. As in Alternative 12a, this alternative would remove the contaminated sediments, thereby eliminating any potential contaminant leaching from the sediments into the water of the lake.

ALTERNATIVE 13: NO ACTION IN RABBIT RUN

Under this no action alternative, contaminants present in Rabbit Run would continue to persist and affect the water quality of Rabbit Run and downstream receiving waters.

ALTERNATIVE 14a: DREDGE AND DEWATER RABBIT RUN SEDIMENTS, DISPOSAL OF SEDIMENTS IN A RCRA FACILITY

Alternative 14a involves the removal of approximately 400 cubic yards of Rabbit Run sediments with a backhoe or similar equipment and placement in a dewatering basin to separate the water and the solids. The dewatered liquids would be treated at the on-site facility. The solids would be disposed of in a new on-site RCRA facility (Option A) or transported to an off-site RCRA facility (Option B) for disposal. Restoration actions would be taken for Rabbit Run as necessary.

ALTERNATIVE 14b: DREDGE AND DEWATER RABBIT RUN SEDIMENTS, TREATMENT FOR ORGANICS, DISPOSAL OF SEDIMENTS AS A NON-HAZARDOUS MATERIAL

Alternative 14b utilizes the same technology as Alternative 14a with an additional treatment step. After dewatering, the sediments would be treated with a rotary kiln drier to remove organic contaminants. The sediments may then be classifiable as non-hazardous and placed at a suitable off-site location. Liquids would be treated at the on-site facility. Restoration actions would be taken for Rabbit Run as needed.

ALTERNATIVE 15: NO ACTION IN THE KIRKWOOD AQUIFER

Under this no action alternative, contaminants present in the Kirkwood aquifer would continue to migrate. The off-site RI reports indicate that the Kirkwood aquifer discharges locally into Chestnut Branch and Alcyon Lake. While this aquifer is not utilized as a drinking water source in the study area, contaminants discharged to surface waters are likely to result in contaminant levels that exceed Federal Water Quality Criteria for surface waters as indicated by evaluations performed during the on-site RI/FS.

ALTERNATIVE 16: PUMP AND TREAT THE KIRKWOOD AQUIFER

Alternative 16 involves the utilization of existing Kirkwood wells and the installation of pumps and a piping system to the on-site treatment facility. The Kirkwood aquifer would be pumped for the duration of the on-site flushing to ensure that all existing and potential future contamination is contained, removed and treated. If needed, pumping would continue after the flushing effort has been completed. Pumping rates, duration of pumping, and cleanup levels to insure the protection of surface water quality, and monitoring associated with this alternative will be incorporated into the monitoring plan that is being developed to evaluate the effectiveness of the on-site remedial actions.

ALTERNATIVE 17: NO ACTION IN CHESTNUT BRANCH STREAM

Under this no action alternative, contaminants present in Chestnut Branch stream would not be remediated. A potential availability of land for such a facility is uncertain. In the event that land was to be secured for this option, the community perception would be extremely negative. Also, while this option would result in a reduction in the mobility of contaminants and would meet ARARs, it would not reduce volume or toxicity and does not address the preference in SARA to utilize treatment technologies or provide a permanent solution.

(B) Transport Contaminated Materials to an Existing RCRA Facility.

This disposal option would attain ARARs and result in a reduction of contaminant mobility. As discussed above, it will not provide a permanent solution or utilize treatment technologies.

(C) Placement of treated materials at the Alcyon Racetrack or on top of the existing Lipari Landfill.

Alcyon Racetrack - As shown in Figure 1, the racetrack is adjacent to Alcyon Lake. Alcyon Park, a public park to the east and south, is owned by the Borough of Pitman, and is moderately used by the local populace. The racetrack and the woods to the west have recently been purchased by the Borough of Pitman to address open space considerations for the Borough and to assist in the off-site remedial process. The racetrack is a clay bowl that is built up to an elevation of six to eight feet higher on the eastern side than the adjacent park. It is approximately 200 feet from the shore of Alcyon Lake and is approximately 35 feet higher in elevation than the lake surface. Although the precise depth to ground water at the race track is unknown, wells in the vicinity indicate that the top of the ground water table is typically 20 to 25 feet below local natural topographic contours. The placement of treated materials at the racetrack will attain ARARs, reduce mobility, toxicity and volume, and is highly cost effective.

As shown in Table 7, the residual metals will attain all present guidelines for soils. This option will be the easiest to implement with respect to the remediation of Alcyon Lake. The Borough has agreed to utilize Alcyon Park as a staging area for dewatering and treatment, and the use of the racetrack for placement of the treated materials. Engineering studies on present racetrack soil conditions as well as post-treatment soil and sediment conditions will be required during the remedial design to ensure that both the short-term and long-term environmental and aesthetic concerns are addressed.

Lipari Landfill - The placement of treated material on top of the existing Lipari Landfill has several drawbacks. An undertaking of this nature would require extensive coordination with the on-site construction activities. The existing design for the injection/extraction well field would have to be for adverse affects on the water quality of the stream would continue to exist due to the leaching of contaminants from the stream sediments.

ALTERNATIVE 18a: DREDGE AND DEWATER CHESTNUT BRANCH SEDIMENTS, DISPOSAL AT A RCRA FACILITY

Alternative 18a involves the same technology and disposal options as Alternative 14a for the Rabbit Run sediments. Restoration actions would be undertaken for Chestnut Branch as necessary.

ALTERNATIVE 18b: DREDGE AND DEWATER CHESTNUT BRANCH SEDIMENTS, TREATMENT FOR ORGANICS, DISPOSAL AS A NON-HAZARDOUS MATERIAL

Alternative 18b involves the same technology and disposal options as Alternative 14b for Rabbit Run. Restoration actions would be undertaken for Chestnut Branch as necessary.

ALTERNATIVE 19: INTERIM MEASURE IN CHESTNUT BRANCH MARSH

Alternative 19 involves the undertaking of temporary remedial measures in Chestnut Branch marsh to mitigate volatile emissions from the seepage face areas. This measure would be undertaken when hazardous emissions from the marsh are considered to pose a potential human health threat. Volatile emissions from the marsh are most pronounced during the warmer Spring and Summer months. The interim measures could involve clearing the vegetation in portions of Zone 3 of the marsh followed by the placement of absorpitve materials and a temporary cap, or the possible use of vapor suppressant technologies. Vapor suppressant foams are available but require repeated applications to be effective. The placement of absorptive materials and a temporary cap would be effective and require little or no maintenance.

DISPOSAL OPTIONS DISCUSSION

In addition to returning treated soils and sediments to their places of origin, the marsh, the streams, the lake, and six other locations were fully evaluated as potential locations for the disposal or placement of treated and non-treated materials. A discussion of the individual disposal options is presented below.

OPTION

(A) Construct a New On-Site RCRA Facility.

While the construction of a new on-site RCRA facility is technically feasible, there are several considerations that detract from this option as a preferred disposal location. The modified to accomodate the addition of three to five feet of treated soils. The impact of this additional soil on the integrity of the existing cap is unknown. Furthermore, while flushing of contaminants has proved successful at other at other hazardous waste sites, and preliminary tests indicate that it also will be successful at the Lipari site, EPA has maintained that, in the event flushing is not successful at Lipari, other remedial measures will be pursued. The presence of additional material on the existing site would add a measure of difficulty in the event of any future intrusive activities, including on-site soil monitoring.

D) Dispose of Treated Materials at the Gloucester County Municipal Landfill.

Disposal of treated soils and sediments at this facility would attain ARARs, reduce mobility, and utilize treatment as a permanent remedy. The cost would be significantly higher than placement at either Alcyon Racetrack or the Lipari Landfill. There also may exist a problem with resource capacity or availability.

Landfill capacity and the need for fill material is very limited in New Jersey. The availability of the use of municipal landfill cells for treated, non-hazardous material is uncertain. Similar institutional problems may be encountered in proposing to use the treated material as fill or cover. Also, it is possible that the community where the landfill facility is located may be hesitant to accept materials, even though treated, from a Superfund site. Further, disposal at a municipal facility would require extensive truck t affic during transportation. Conversely, the use of Alcyon Racetrack as a placement location would not require truck traffic in Pitman or in the surrounding communities.

(E) Disposal at Montgomery County Suburban Landfill of Treated Materials.

The same advantages and disadvantages apply to this option as exists for the Gloucester County Municipal Landfill.

The placement of treated material back into Alcyon Lake was rejected in the FS because of concerns over blocking artesian springs originating in the Kirkwood aquifer. The increase in flow to Alcyon Lake provided by these springs will assist in attaining the goal of maintaining fishable/swimmable water quality in Alcyon Lake. Futhermore, metals are not expected to be significantly affected by the treatment process. At present, there are no promulgated standards or guidelines to address contaminant concentrations in sediments. However, it is accepted scientific knowledge that many contaminants, especially metals, are significantly more mobile in a sediment/water interface than are metals in a soil that is not in contact with ground water. Daily fluctuations in the pH of aquatic systems, as well as the activity of benthic organisms, lead to increases in the dissolution of metals from sediments to the aqueous phase. The alternatives that utilize treatment and placement of treated soils and sediments in non-aqueous environments will provide better assurances of maintaining surface water quality.

SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The previously discussed alternatives were evaluated using evaluation criteria derived from the NCP and the Superfund Amendments and Reauthorization Act of 1986. The criteria relate directly to factors mandated by SARA in Section 121, including Section 121(b)(1)(A-G) and EPA Interim Guidance on Selection of Remedy (December 24, 1986 and July 24, 1987). The criteria are as follows:

- Compliance with legally applicable or relevant and appropriate requirements (ARARs)
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Long-term effectiveness
- Implementability
- Protection of human health and the environment
- Community acceptance
- State acceptance
- Cost

A summary of the discussion of these criteria, with the exception of State acceptance, is contained in Table 8. Due to the high level of agreement between EPA and NJDEP on the proposed remedial actions in the off-site areas, a separate column was not presented in the summary. The criteria of protection of human health and the environment was divided into two columns to more fully describe these two important areas. A discussion of the objectives of the nine evaluation criteria is provided below.

Compliance with ARARs

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with all applicable or relevant and appropriate Federal and State requirements for the hazardous substances, pollutants, or contaminants that are present and attributable to a site. The contaminated soils and sediments in the off-site areas are impacting the quality of water in contact with the soils of Chestnut Branch marsh and the sediments of Rabbit Run, Chestnut Branch stream and Alcyon Lake. As such, cleanup of these areas is necessary to achieve water quality ARARs. The same rationale applies to the marsh ground water collection system. The alternatives that utilize treatment and placement of treated soils and sediments in non-aqueous environments will provide better assurances to maintaining surface water quality. These includes Alternatives 7b, 9b, 12a, 12b, 14a, 14b, 18a, and 18b.

Contaminants in marsh soils outside of the slurry wall serve as a reservoir for future contaminant migration to adjacent surface waters. Collection of ground water in the marsh will intercept these contaminants as well as any potential migration of contaminants in ground water that may occur as a result of the on-site flushing activities. Alternative 2a and 2b provide the best assurances of capturing leachate in the marsh, and in meeting the intent of the September 30, 1985 ROD. The marsh collection system will be placed as close to the slurry wall as possible within the limits of construction technology. Soil east and north of the collection system in the marsh will be excavated and thermally treated to remove organic contaminants that are presently affecting water quality in downstream receiving waters. The rotary drier technology will result in the removal of organic contaminants from the marsh soils. In order to avoid creating an air emission problem, vapor controls shall be utilized in order to meet, at a minimum, NJDEP air emission standards (NJAC Title 7, Chapter 27, Subchapter 17). Specific technological considerations such as retention time, operating temperatures, and optimum vapor collection technologies will be determined during the remedial design.

Ground water extraction from the Kirkwood aquifer (Alternative 16) is also being undertaken to protect surface water quality and to meet the intent of the September 30, 1985 ROD. In New Jersey, the Kirkwood aquifer is classified as a GW-2 drinking water aquifer. In the immediate vicinity of the Lipari Landfill site, the Kirkwood is not utilized as a drinking water source. Due to the poor yield of the formation (Off-Site RI, phases 1 and 2) and the abundance of high yeild aquifers in the local area, it is unlikely that the Kirkwood aquifer in the site vicinity would be utilized as a drinking water source in the future. The area of contamination in the Kirkwood is confined to the upper portion of the formation. The Kirkwood has been characterized as flowing upwards into Chestnut Branch stream, with this surface water stream acting as the discharge point and hydrologic boundary for contaminant migration in the Kirkwood aquifer. For these reasons, in this unique situation, the application of surface water standards should be applied to cleanup goals for the Kirkwood aquifer. Chestnut Branch and Alcyon Lake are classified as FW2-NT. The surface water quality criteria for this classification are listed in Table 6. For those compounds, such as bis(2-chlorethyl)ether that are not listed in the FW2-NT classification, Federal Water Quality Criteria established under the Clean Water Act should be applied as a guideline for cleanup goals. A chemical-specific list of compounds detected in the Kirkwood aquifer and corresponding Federal Water Quality Criteria are listed in Table 6.

The need for additional extraction wells to best ensure that contaminants present in the Kirkwood aquifer are removed in order to minimize impact on surface water quality will be determined during remedial design. The extraction and treatment of ground water from this formation should continue, at a minimum, for the duration of the on-site flushing. The specific rate of flushing and any allowable residual concentration of contaminants will be incorporated into the Monitoring Plan and will reflect surface water quality criteria. A similar approach will be taken with respect to the collection of leachate in the marsh area.

The placement of treated soils and sediments at the Alcyon Racetrack would not exceed current RCRA guidelines concerning the disposal of treated materials. Soils and sediments have been examined using the Extraction Procedure Toxicity (EP-TOX) test for metals and pesticides. The tested materials have not exhibited hazardous characteristics associated with the EP-TOX procedure and have not been classified as a listed waste, therefore, are not considered to be a RCRA waste. In addition to the EP-TOX procedure, the Toxic Characteristics Leaching Procedure (TCLP) which includes an analysis for organic compounds has been developed to further define leaching characteristics. The EP-TOX procedure will be used on treated materials during remediation to ensure a level of treatment that is protective of human health and the environment. Additional tests such as the TCLP test will be utilized as needed to ensure that effective treatment that is protective of human health and the environment is achieved.

Reduction of Toxicity, Mobility or Volume

This evaluation criteria involves the performance of a technology or remedial alternative in terms of eliminating or controlling risks posed by the toxicity, mobility or volume (TMV) of hazardous substances. The ability of each alternative to attain this criteria is summarized in Table 9. Alternatives that utilize treatment provide the best assurances that a reduction in TMV will be achieved. Off-site collection will reduce the mobility of contaminants in the ground water, on-site treatment will reduce toxicity and volume. For the marsh, Alternatives 2a and 2b provide the best assurances that TMV will be reduced. Alternative 2b will reduce the amount of clean water infiltration to the trench, thereby reducing the total volume of collected material to be treated. Alternatives 9b, 12b, 14b, and 18b provide the best assurances for TMV reduction in the marsh, streams and lake. These alternatives all utilize treatment technologies. Excavation and RCRA disposal does not affect the toxicity or volume; treatment followed by replacement in original areas does not affect the mobility of metals.

Short-Term Effectiveness

The short-term effectiveness criteria measures how well an alternative is expected to perform, the time to achieve performance, and the potential adverse impacts of its implementation. Alternatives that utilize excavation and/or excavation and treatment have an increased potential for short-term adverse impacts associated with short-term exposure to contaminant releases. This includes Alternatives 6 through 10 (a and b), Alternatives 12 a and b, 14 a and b, and 18 a and b. The short-term impacts of the alternatives are summarized in Table 9. These impacts can be mitigated through proper health and safety controls.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence addresses the long-term protection and reliability of an alternative. The evaluation of the alternatives under this criteria is presented in Table 9. The removal and treatment of contaminated soils and sediments will ensure that water quality and air quality goals are met. Alternatives 9b, 10b, 12b, 14b, and 18b achieve these goals. Alternatives 2b and 16 will provide assurances that contaminated ground water does not impact local surface waters. Specific engineering considerations of the rotary kiln technology such as operating temperature, retention time, and off-gas treatment will be determined during the remedial design. Optimization of these parameters to maximize the removal of contaminants coupled with proper soil engineering practices will ensure that the placement of treated materials at the Alcyon Racetrack will not require future monitoring and will result in a permanent remedy. As described previously and shown in Table 8, residual metals are not expected to pose a human health or environmental concern.

Implementability

Implementability addresses how easy or difficult, feasible or infeasible, it would be to carry out a given alternative. This covers implementation from design through construction and operation and maintenance. The implementability of the alternative is evaluated in terms of technical and administrative feasibility, and availability of needed goods and services. All alternatives have resource requirements with the exception of the No Action alternatives (4, 11, 13, 15, and 17). All actions utilize resources that have been implemented with available, proven technologies. The summary of the evaluation of the alternatives under this criteria is presented in **Table** 9.

Protection of Human Health and the Environment

Protection of human health and the environment is the central mandate of CERCLA as amended by SARA. Protection is achieved by taking appropriate actions to ensure that there will be no unacceptable risks to human health and the environment through any exposure pathways.

The excavation, dredging, dewatering, thermal treatment (Alternatives 2b, 9b, 10b, 12b, 14b, 16 and 18b), and final placement of treated materials at the Alcyon Racetrack coupled with the on-site flushing/leachate collection and treatment action will ensure that the existing off-site contamination from the Lipari Landfill is permanently removed from the environment and that no future off-site contaminant migration occurs.

Contaminated soils and sediments in the off-site areas passed the EP-TOX test and, therefore, are not considered to exhibit adverse leaching characteristics relative to metals and pesticides. Material as it is processed will be analyzed using the EP-TOX test for leaching characteristics and other tests such as the TCLP test, which includes analyses for volatile organics, as needed. Target Compound List (TCL) analyses for individual hazardous compounds will also be performed during treatment to ensure that the treated materials conform with acceptable environmental guidelines such as those established by the State of New Jersey for soil cleanup.

The impacts on the health and safety of workers and nearby residents will be closely monitored during remedial actions. Excavation in the Chestnut Branch marsh is likely to cause the most significant environmental and human health concerns due to the potential for contact with contaminated soil by workers, inhalation of hazardous volatile organics during excavation, and transport of contaminated sediments to downstream receiving waters.

Appropriate measures would need to be taken during excavation of the marsh soils to protect workers and nearby residents. Among the candidate possibilities for reducing volatile emissions and improving construction conditions are the following;

- Lowering of the ground water table in the immediate vicinity. This may be accomplished by one or more of the following methods: dewatering the containment system; pumping from well points in the Cohansey; pumping from well points in the Kirkwood, temporarily rerouting Chestnut Branch and/or Rabbit Run.

- The use of vapor suppressant technologies such as vapor suppressant foam and portable inflatable worktents.

The workers and residents would be protected through measures outlined in project-specific health and safety plans and through contractor adherance to Occupational Safety and Health Act (OSHA) regulations. Strict air monitoring at the construction site as well as in the nearby residential areas would need to be implemented. Noise associated with the rotary drier unit may need to be mitigated through noise suppressant housing or insulation. It is not anticipated that any such noise would be noticible except possibly during night-time operation, if night-time operation is acceptable to the local community. Dust and particulate matter are not expected to be a concern due to the damp nature of the marsh soils and the lake and stream sediments.

The disturbance of soils during marsh excavation and sediments during dredging will likely result in an increase in suspended sediments that may carry contaminants into the local surface waters. Rerouting of streams, the use of silt curtains, and limiting the flow of water at the Alcyon Lake spillway would all result in a minimization of the transport of suspended solids in local surface waters.

Community Acceptance

This evaluation criterion addresses the degree to which members of the local community support the remedial alternatives being evaluated.

The community has shown a great deal of support for the proposed off-site cleanup. The mayor and the town council of the Borough of Pitman moved to purchase the Alcyon Racetrack in order to expedite the off-site cleanup action. The Borough already owned the adjacent park and had debated purchasing the racetrack and adjoining woods for several months. By purchasing that property, Pitman has assured that:

(1) land for placement of treated materials will be available;

(2) a complete staging and disposal area is removed from residential areas;

(3) truck transportation traffic will not impact the local communities; and

(4) remediation can be performed at a relatively low cost.

Mr. Douglas Zee owns the property (orchards) between the landfill and the racetrack. Discussions with Mr. Zee indicate that he is willing to allow truck access to roads on his property between the Lipari Landfill and the racetrack. The completion of a formal access and easement agreement with Mr. Zee would ensure that truck traffic impact in the community is kept to a minimum. Existing roads are shown in Figure 1. The specific concerns of the community with regard to the remedial activities include, suppression of volatile emissions during excavation and dredging, noise associated with the rotary drier, off-gas collection/treatment of contaminants from the rotary drier, testing of treated materials during and after treatment to assure effectiveness of the treatment, potential public health and environmental impacts associated with residuals in treated materials, final aesthetic appearance of the racetrack area, and use restrictions on the racetrack area. Detailed responses to the community concerns are contained in the Responsivness Summary (Attachment F).

A corollary issue associated with the impact of the Lipari Landfill on Alcyon Lake is the need for a watershed management plan to address other point and non-point sources of pollution which may impact the lake. Efforts are underway to integrate the off-site remediation with the goals of a comprehensive watershed management plan.

Cost

Costs are evaluated in terms of capital costs, operation and maintence costs, and present worth costs. These items are included in Table 9. The costs associated with the prefered off-site remediation of Alcyon Lake, Rabbit Run and Chestnut Branch stream represent the lowest costs for the remediation of these areas. This is significant in that the prefered alternatives also involve treatment to achieve a permanent remedy. The cost associated with remediating Chestnut Branch marsh is not the lowest, however, it does provide the greatest assurance for protection of public health and the environment.

The collection of leachate (Alternatives 2b and 16) addresses the requirements of the September 30, 1985 ROD. Alternative 16 will utilize the existing wells to the extent that it is feasible (a pumping network will be required and the need for additional wells will be evaluated during the remedial design) as well as the on-site treatment facility. Costs associated with this option primarily involve operation and maintenance. Collection of leachate in the marsh area, Alternative 2b, is not the least expensive alternative for collection of seepage in the marsh. However, it does provide the greatest degree of public health and environmental protection and, further, has the lowest operation and maintenance costs. The range of costs associated with Alternatives 1, 2a, 2b, and 3 vary by less than 10 percent ($5,788,000 to $6,365,000). Table 10 shows the costs associated with the preferred alternatives, and the range associated with other candidate alternatives for the same operable unit.

SELECTED REMEDY

Through the comparative analysis described in the preceeding section and as outlined in Table 9 and in the off-site FS, the remedy that has been selected which provides the best balance among the criteria and satisfies the statutory requirements of Section 121 of CERCLA, as amended, is a combination of Alternatives 2b, 9b (Option 2) 12b, 14b, 16, 18b, and 19 with placement of treated materials at the Alcyon Racetrack. The off-site collection system (Alternatives 2b and 16) will ensure that contaminated ground water in the Cohansey and Kirkwood aquifers does not discharge into Chestnut Branch stream. These actions will ensure that surface water criteria under the Clean Water Act and New Jersey surface water standards are achieved. Alternative 9b will ensure that contaminants present in the Chestnut Branch marsh do not continue to migrate and impact local surface waters and sediments. Exposure routes for air inhalation and soil contact characterized as posing potential long-term human health threats will also be eliminated. Alternative 12b will remove and treat contaminated sediments that contain contaminants present in the water column of the lake at levels that exceed FWQC. Additionally, BCEE has been detected in fish tissue from the fish of Alcyon Lake. Ingestion of fish from the lake was characterized as an exposure pathway associated with a long-term human health threat. Appropriate sampling and any necessary removal, relocation, and/or restocking of aquatic wildlife will be made prior to lake remediation. Alternatives 14b and 18b will remove and treat contaminated sediments in Rabbit Run and Chestnut Branch stream that contain contaminants present in the water column at levels that exceed surface water criteria and standards. All of the downstream and downgradient areas have been shown to contain elevated levels of Lipari related contaminants.

The use of the Alcyon Racetrack as an area to place treated, non-hazardous material will be in compliance with ARARs, provide protection of human health and the environment, is easily implemented, will provide long-term effectiveness, and has the support of the local community. At present, the only guidelines available for soils are New Jersey soil cleanup objectives. As discussed earlier, treated material is expected to be within the guidelines of those objectives. During remedial design activities the determination of site-specific information such as soil properties and depth to ground water will be incorporated into a determination of minimum site specific cleanup levels for soils and sediments prior to their placement at the racetrack. The levels that will be set will ensure protection of human health and the environment. The estimated cost associated with the selected remedy is $21 million (Table 10).

STATUTORY FINDINGS/SUMMARY

The selected remedy satisfies the nine evaluation criteria to the greatest degree of the alternatives examined.

The Agency has been explicitly directed by Congress in Section 121(b) of CERCLA, as amended, to select remedial actions which utilize permanent solutions and alternative treatment technologies or resource recovery options to the maximum extent practicable. In addition, the Agency is to prefer remedial actions that permanently and significantly reduce the mobility, toxicity or volume of site wastes. Applying this statutory preference here, Alternatives 9b, 12b, 14b and 18b provide the greatest degree of long-term effectiveness and permanence by utilizing a treatment technology that will permanently remove organic contaminants attributable to the Lipari Landfill in the off-site areas. In addition, excavation and dredging will also fulfill the preference for permanent elimination or reduction of the public health and environmental risk. Because of the potential mobility of the contaminants in sediments and the bioaccumulation in fish, this permanent solution is appropriate. There would be virtually no residual risk associated with this alternative since the organic contaminants would be removed through the thermal treatment process and the excavation and dredging plans. Also, there would be no need for eventual replacement of the remedy since the residuals from the treatment process will be non-hazardous. Finally, this remedy is reliable and will avoid the long-term uncertainties associated with land disposal of untreated wastes. Hence, protection of human health and the environment on a long-term permanent basis is best assured by the selected actions. These actions, coupled with leachate collection and treatment in the Cohansey and Kirkwood aquifers (Alternatives 2b and 16), ensure the permanent elimination of Lipari related contaminants in the off-site environment.

The thermal treatment process would comply with all action specific ARARs. In addition, the residuals from the thermal treatment would be determined non-hazardous and would not pose a threat to human health or the environment through any exposure pathway.

The Agency believes that the rotary kiln drier technology is available and reliable for the treatment of contaminated soils and sediments existing in the vicinity of the Lipari Landfill site. This technology has been successfully implemented at the McKin Superfund site in Gray, Maine to remove volatile organics and PAHs (polyaromatic hydrocarbons) from soils. .The land area is available for the siting of the treatment process units and placement of the treated, non-hazardous soils and sediments. Pilot testing of the equipment would be utilized to ensure the operational reliability of the unit on site-specific soils and sediments. Although this remedy would require measures to control possible risks related to construction and operation (e.g. air emissions), the Agency's analysis indicates that all of these factors can be adequately controlled.

The capital costs for thermal treatment of the soils and sediments followed by placement at the Alcyon Racetrack are less than the costs associated with disposal (with or without treatment) at a municipal or RCRA facility. Futhermore, because the thermal treatment process represents a permanent remedy, there would be no long-term operation and maintenance costs associated with future monitoring. While the selection of the remedy involves the balancing of costs and effectiveness against the relative benefits of each alternative, the Agency is statutorily required to favor remedies that are permanent and that utilize treatment technologies which permanently and significantly reduce the toxicity, mobility or volume of the contaminants.

The selected actions represent the best balance of the nine evaluation criteria and are cost-effective, permanent solutions to contamination problems existing in the environment.

The community prefers that all of the contaminated soils and sediments in the off-site areas be excavated/dredged and treated to permanently remove contaminants. While there has been some local apprehension at placing the non-hazardous treated materials at the Alcyon Racetrack, the majority of the local citizens and elected officials strongly favor this option. The primary community concerns to be addressed during remediation will be noise, odors, and vapor controls associated with the remedial actions. In addition, demonstration of the effectiveness of the treatment processs would be required. Restoration of the racetrack area to an acceptable aesthetic level would also be required.

The selected remedy would be protective of human health and the environment by: 1) utilizing treatment to reduce toxicity and mobility of the waste; 2) being the most effective and permanent solution in the long-term; 3) being relatively easy to implement; and 4) assuring short-term effectiveness. Furthermore, Altenatives 2b and 16 would meet the intent of the September 30, 1985 ROD relative to leachate collection.

In summary, EPA has selected Alternatives 2b, 9b, 12b, 14b, 16, 18b, and 19 because they are protective of human health and the environment, will attain all applicable or relevant and appropriate requirements, are cost-effective, and utilize permanent solutions and treatment technologies or resource recovery options to the maximum extent practicable. Additionally, since these alternatives employ thermal treatment to eliminate the principal threat at the site, this option would also satisfy SARA's preference for remedies which employ treatment as their principal element to permanently and significantly reduce toxicity, mobility or volume of the contaminants.

SECTION V

ATTACHMENTS

ATTACHMENT A

GROUNDWATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

	LiPari Landfill sampling					
	Radian Corp.					
Volatile organic contaminant	Field[a] 1983 (ppb)	Lab[b] 1983 (ppb)	JRB[c] 9/26/83 (ppb)	IT Corp[c] 9-10/84 (ppb)	JRB[c,d] 12/84-4/85 (ppb)	CDM[e,f] 3/85 (ppb)
Acrolein	NR	NR	NA	<500	NA	NA
Acrylonitrile	NR	NR	ND	<500	NA	NA
Benzene	3,000	4,500	5,900	2,200	29,000	1,371
Bromoform	NR	NR	<500[g]	<50	NA	<10[g]
Bromomethane	NR	NR	NA	NA	NA	<10[g]
Carbon tetrachloride	NR	NR	<100[g]	<50	NA	<10[g]
Chlorobenzene	18	<50	270	110	NA	1,005
Chlorobromomethane	NR	NR	<100[g]	<50	NA	<10[g]
Chloroethane	12	<50	47,<100[g]	<50	NA	<10[g]
2-Chloroethylvinyl ether	NR	NR	<250[g]	500	NA	<10[g]
Chloroform	8	48	760	<50	NA	750
Chloromethane	NR	NR	NA	NA	NA	<10[g]
Dichlorobromomethane	NR	NR	300	<50	NA	<10[g]
Dichlorodifluoromethane	NR	NR	<250[g]	<500	NA	<10[g]
1,1-Dichloroethane	54	<50	760	18	630	588
1,2-Dichloroethane	5,900	8,100	5,500,<69,000[h]	41,000	54,000	75,459
1,1-Dichloroethylene	4	<50	78	<50	NA	148
1,2-Dichloropropane	NR	NR	24,<50[g]	<50	NA	<10[g]
1,3-Dichloropropylene	NR	NR	7,<250[g]	50	NA	<10[g]
Ethylbenzene	1,000	420	4,400	2,000	NA	619
Methyl bromide	NR	NR	<500[g]	<500	NA	NA
Ethene dibromide	NR	NR	NA	NA	NA	<20[g]
Methyl chloride	NR	NR	<1,000[g]	<500	NA	NA
Methylene chloride	510	3,300	39,000	2,800	46,000	17,450
1,1,2,2-Tetrachloroethane	NA	NR	<500[g]	<50	NA	<10[g]
Tetrachloroethylene	7	<50	40,<100[g]	130	NA	92
Toluene	9,900	30,000	75,000	37,000	87,000	2,056
trans-1,2-Dichloroethene	26	<50	360	88	NA	219
1,1,1-Trichloroethane	1	<50	73,<100[g]	<50	NA	<10[g]
1,1,2-Trichloroethane	NR	NR	<250[g]	<50	NA	<10[g]
Trichloroethylene	14	<50	21,<100[g]	220	NA	177
Trichlorofluoromethane	NR	NR	<250[g]	<50	NA	699
Vinyl chloride	10	<50	96,<100[g]	<500	NA	<10[g]
Total volatile organic compounds	NR	NR	NA	NR	NA	176,962

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

	LiPari Landfill sampling					
	Radian Corp.					
Extractable contaminant	Field[a] 1983 (ppb)	Lab[b] 1983 (ppb)	JRB[c] 9/26/83 (ppb)	IT Corp[c] 9-10/84 (ppb)	JRB[c,d] 12/84-4/85 (ppb)	CDM[e,f] 3/85 (ppb)
Acid extractables:						
2-Chlorophenol	NR	NR	<500[g]	<40	NA	22
2,4-Dichlorophenol	9	ND	15,<500[g]	13,<40	NA	14
2,4-Dimethylphenol	NR	NR	<500[g]	<40	NA	<10[g]
1,4-Dinitrophenol	NR	NR	NA	NA	NA	35
4,6-Dinitro-*o*-cresol	NR	NR	<5,000[g]	<40	NA	NA
2,4-Dinitrophenol	NR	NR	<5,000[g]	<40	NA	40
2-Nitrophenol	NR	NR	<500[g]	<40	NA	20
4-Nitrophenol	110	ND	<500[g]	<40	NA	NA
p-Chloro-*m*-cresol	NR	NR	<500[g]	<40	NA	<10[g]
2-Methyl-4,6-dinitrophenol	NR	NR	NA	NA	NA	<10[g]
Pentachlorophenol	NR	NR	<500[g]	<40	NA	NR
Phenol	11,000	22,000	22,000	9,000	NA	<10[g]
2,4,6-Trichlorophenol	NR	NR	<500[g]	<40	NA	20
Base-neutral extractables:						
Acenaphthene	NR	NR	<100[g]	<40	NA	<50[g]
Acenaphthylene	NR	NR	<100[g]	5.6,<40	NA	<50[g]
Anthracene	NR	NR	<100[g]	<40	NA	<50[g]
Benzidine	NR	NR	<1,000[g]	<160	NA	<100[g]
Benzo(a)anthracene	NR	NR	<1,000[g]	<40	NA	<50[g]
Benzo(a)pyrene	NR	NR	<1,000[g]	<40	NA	<50[g]
3,4-Benzofluoranthene	NR	NR	<100[g]	<40	NA	<50[g]
Benzo(g,h,i)perylene	NR	NR	<250[g]	<40	NA	<50[g]
Benzo(k)fluoranthene	NR	NR	<100[g]	<40	NA	<50[g]
bis(2-Chloroethoxy)methane	NR	NR	<200[g]	<40	NA	<50[g]
bis(2-Chloroethyl)ether	8,000	12,000	83,000	15,600	510,000	44
bis(2-Chloroisopropyl)ether	NR	NR	<200[g]	<160	NA	<50[g]
bis(2-Ethylhexyl)phthalate	NR	NR	65,<100[g]	<40	NA	<50[g]
4-Bromophenyl phenyl ether	NR	NR	<100[g]	<40	NA	<50[g]
Butylbenzyl phthalate	NR	NR	<100[g]	4.0,<40	NA	<50[g]
2-Chloronaphthalene	NR	NR	<200[g]	<40	NA	<50[g]
4-Chlorophenyl phenyl ether	NR	NR	<100[g]	<40	NA	<50[g]
Chrysene	NR	NR	<100[g]	<40	NA	<50[g]
Dibenzo(a,h)anthracene	NR	NR	<250[g]	<40	NA	<50[g]
1,2-Dichlorobenzene	150	ND	370,<400[g]	440	NA	49
1,3-Dichlorobenzene	NR	NR	<400[g]	<40	NA	27
1,4-Dichlorobenzene	NR	NR	190,<400[g]	3.0,<40	NA	1,619
3,3'-Dichlorobenzidine	NR	NR	<100[g]	<40	NA	<100[g]

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

	LiPari Landfill sampling					
	Radian Corp.					
Extractable contaminant	Field[a] 1983 (ppb)	Lab[b] 1983 (ppb)	JRB[c] 9/26/83 (ppb)	IT Corp[c] 9-10/84 (ppb)	JRB[c,d] 12/84-4/85 (ppb)	CDM[e,f] 3/85 (ppb)
Base-neutrals, continued						
2,4-Dichlorotoluene	NR	NR	NA	NA	NA	5,018
m-Chlorotoluene	NR	NR	NA	NA	NA	3,983
Diethyl phthalate	10	<1	350	94	NA	<50[g]
Dimethyl phthalate	NR	NR	<100[g]	<40	NA	<50[g]
Di-*n*-butyl phthalate	6	<1	44	<40	NA	<50[g]
2,4-Dinitrotoluene	NR	NR	<100[g]	<40	NA	<50[g]
2,6-Dinitrotoluene	NR	NR	<100[g]	<40	NA	<50[g]
Di-*n*-octyl phthalate	NR	NR	<100[g]	<40	NA	<50[g]
1,2-Diphenylhydrazine (as azobenzene)	NR	NR	<100[g]	<40	NA	<250[g]
Ethyleneimine	NR	NR	NA	NA	NA	<50[g]
Fluoroanthene	NR	NR	<100[g]	<40	NA	<50[g]
Fluorene	NR	NR	<100[g]	<40	NA	<50[g]
Hexachlorobenzene	NR	NR	<100[g]	<40	NA	<50[g]
Hexachlorobutadiene	NR	NR	<200[g]	<40	NA	<50[g]
Hexachlorocyclopentadiene	NR	NR	<200[g]	<40	NA	<50[g]
Hexachloroethane	NR	NR	<400[g]	<40	NA	<50[g]
Ideno(1,2,3-cd)pyrene	NR	NR	<250[g]	<40	NA	<50[g]
Isophorone	180	160	<200[g]	<160	NA	<50[g]
Naphthalene	70	280	430	120	NA	<50[g]
Nitrobenzene	NR	NR	<200[g]	<40	NA	<50[g]
N-Nitrosodimethylamine	NR	NR	ND	<40	NA	<50[g]
N-Nitrosodi-*n*-propylamine	NR	NR	ND	<40	NA	<50[g]
N-Nitrosodiphenylamine	NR	NR	<100[g]	<40	NA	<50[g]
Phenanthrene	NR	NR	<100[g]	<40	NA	<50[g]
Pyrene	NR	NR	<100[g]	<40	NA	<50[g]
1,2,4-Trichlorobenzene	NR	NR	<200[g]	<40	NA	5,965
1,2-*bis*(2-Chloroethoxy) ethane	30-70,000	30-70,000	140,000	NA	1,600,000	NA
bis(Chloromethyl)ether	NR	NR	NA	<40	NA	NA
2,3,7,8-Tetrachlorodi-benzo-*p*-dioxin	NR	NR	NA	<40	NA	NA
1,4-Diethylene dioxide	NR	NR	NA	NA	NA	<50[g]

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

	LiPari Landfill sampling					
	Radian Corp.					
Pesticide/PCB contaminant	Field[a] 1983 (ppb)	Lab[b] 1983 (ppb)	JRB[c] 9/26/83 (ppb)	IT Corp[c] 9-10/84 (ppb)	JRB[c,d] 12/84-4/85 (ppb)	CDM[e,f] 3/85 (ppb)
Aldrin	NR	NR	<2[i]	<1	NA	<0.5[g]
BHC,alpha	NR	NR	<2[i]	<1	NA	<0.5[g]
BHC,beta	NR	NR	<2[i]	<1	NA	<0.5[g]
BHC,delta	NR	NR	<2[i]	<1	NA	<0.5[g]
BHC,gamma	NR	NR	2.2	<1	NA	<0.5[g]
Chlordane	NR	NR	ND	<10	NA	<0.5[g]
4,4'DDT	NR	NR	ND	1	NA	<0.5[g]
4,4'DDE	NR	NR	ND	<1	NA	<0.5[g]
4,4'DDD	NR	NR	ND	<1	NA	<0.5[g]
Dieldrin	NR	NR	ND	<1	NA	<0.5[g]
Endosulfan-alpha	NR	NR	2.1	<1	NA	<0.5[g]
Endosulfan-beta	NR	NR	2.1	<1	NA	<0.5[g]
Endosulfan sulfate	NR	NR	ND	<1	NA	<0.5[g]
Endrin	NR	NR	<2[i]	<1	NA	<0.5[g]
Endrin aldehyde	NR	NR	2	<1	NA	<0.5[g]
Endrin ketone	NR	NR	NA	NA	NA	<0.5[g]
Heptachlor	NR	NR	<2[i]	<1	NA	<0.5[g]
Heptachlor epoxide	NR	NR	2	<1	NA	<0.5[g]
PCB-1242	NR	NR	<25[g]	<10	NA	<0.5[g]
PCB-1254	NR	NR	<25[g]	<10	NA	<1.0[g]
PCB-1221	NR	NR	<25[g]	<10	NA	<0.5[g]
PCB-1232	NR	NR	<25[g]	<10	NA	<0.5[g]
PCB-1248	NR	NR	<25[g]	<10	NA	<0.5[g]
PCB-1260	NR	NR	<25[g]	<10	NA	<1.0[g]
PCB-1016	NR	NR	<25[g]	<10	NA	<0.5[g]
Toxaphene	NR	NR	ND	<10	NA	<0.5[g]
Methoxychlor	NR	NR	NA	<1	NA	<0.5[g]

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

Volatile nonpriority pollutant	IT Corp[c] 9-10/84 (ppb)	Base-neutral extractable nonpriority pollutant	IT Corp[c] 9-10/84 (ppb)
Acetone	620	Aniline	<40
2-Butanone	100,<500	Benzoic acid	460
Carbon disulfide	<50	Benzyl alcohol	29,<40
2-Hexanone	23,000	4-Chloroaniline	5.2,<40
4-Methyl-2-pentanone	7,700	Dibenzofuran	<40
Styrene	1,100	2-Methylnaphthalene	2.1,<40
Vinyl acetate	<50	2-Methylphenol	180
o-Xylene	9,200	4-Methylphenol	100
Total xylenes	3,500	2-, 3-, 4-Nitroanilines	<40 each
		2,4,5-Trichlorophenol	<40

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

Metal contaminant	Radian[a] 1983 (ppm)	JRB[c] 9/26/83 (ppm)	IT Corp[c] 9-10/84 (ppm)	CDM[e,f] 3/85 (ppm)
Antimony	<.005	<.20/.21[j]	<.001	<0.01[g]
Arsenic	<.003	.074/.087[j]	.016	<0.002[g]
Barium	NR	NA	NA	.40
Beryllium	<.0005	<.05	<.001	<0.01[g]
Cadmium	<.005	.023/.068[j]	.011	.006
Chromium	<.001	5.1/51.0[j]	.050	<0.02
Copper	.062	.15/.20[j]	.25	<0.01[g]
Iron	86	NA	NA	NA
Lead	<.003	.12/.92[j]	.01	.06
Manganese	.20	NA	NA	NA
Mercury	<.0002	.013	.0042	<.001[g]
Nickel	.004	.30/.70[j]	.05	.07
Selenium	<.003	.21	.006	<0.01[g]
Silver	<.002	.026/.080[j]	.003	<0.01[g]
Thallium	<.003	.27	<.001	<0.002[g]
Zinc	.071	1.2/1.3[j]	3.96	.14
Cyanide	NR	.02	NA	4.95
Phenols	NR	18.4	NA	NA

GROUND WATER CHARACTERISTICS OF LIPARI LANDFILL SAMPLES

Conventional parameter	IT Corp[c] 9-10/84 (ppm)	DuPont[e] 3/85 (ppm)	CDM[e,f] 3/85 (ppm)
Dissolved organic carbon	NA	863	NA
pH	NA	6.3	6.3
Total suspended solids	NA	70	532[k]
Biochemical oxygen demand	NA	NA	1,319
Chemical oxygen demand	NA	NA	2,820
Ammonia-nitrogen	NA	NA	55.55
Total kjeldahl nitrogen	NA	NA	57.65
Phosphorous	NA	NA	NA
Phosphate	NA	NA	0.37
Total dissolved solids	NA	NA	1,536
Total volatile suspended solids	NA	NA	164
Volatile dissolved solids	NA	NA	490
Conductivity	NA	NA	1,900 umho/cm
Oil and grease	4.8	NA	7.7
Total organic carbon	240	NA	NA
Chlorides	NA	NA	318.2
Nitrates	NA	NA	0.03
Alkalinity	NA	NA	327
Hardness as $CaCO_3$	NA	NA	188

[a] Laboratory composite of samples from monitoring wells C-10a, C-6a, and C-4a.

[b] Composite of sample drums upon receipt at laboratory.

[c] Highest value (worst case) is indicated.

[d] Limited sampling done by JRB Associates from December 10, 1984, to April 15, 1985. There were four sampling events performed during this period.

[e] Collected from production well PW-1 at conclusion of 24-hour pump test.

[f] Field measurements performed by Camp Dresser & McKee, Inc., in March of 1985 indicated leachate temperatures ranging from 10 to 16 °centigrade.

[g] Element is less than value given and not detected by the technique employed. Report with detection limit.

[h] Due to the high interference levels encountered, an unusually high detection limit exists. An undeterminable amount of results may be due to 1,2-dichloroethane.

[i] Below method detection limit. Quantitation and/or identification may be uncertain at this level.

[j] Highest value represents the maximum concentration found in shallow driven wells outside of containment system.

[k] May be low due to extended holding time of sample.

Notes: NR Not reported; NA Not analyzed; ND Not detected

ATTACHMENT B

SUMMARY TABLES FOR OFF-SITE LIPARI SAMPLING PROGRAMS

Onsite Soils - Baseline Soil Sampling Results CDM 1987

	Average (µg/kg)	Maximum (µg/kg)		Average (µg/kg)	Maximum (µg/kg)		Average (mg/kg)	Maximum (mg/kg)		Average (mg/kg)	Maximum (mg/kg)
SEMIVOLATILES			**VOLATILES**			**INORGANICS**			**PESTICIDES**		
Phenol	10,938	130,000	Acetone	5,914	43,000	Antimony	7.5	11	Aroclor 1248	9,788	11,750
bis(2-chloroethyl)ether	12,241	310,000	Methylene Chloride	3,500	20,000	Arsenic	3.5	30	4,4'-DDT	57	170
2-Chlorophenol	19,550	36,000	Carbon Disulfide	220	1,300	Barium	10.5	35	4,4'-DDD	569	2,400
1,3-Dichlorobenzene	220	220	trans-1,2-Dichloroethene	9	9	Beryllium	0.7	1.6	4,4'-DDE	3,395	31,000
1,4-Dichlorobenzene	1,116	2,200	Chloroform	94	1,800	Cadmium	1.3	50	Dieldrin	110	110
Benzyl Alcohol	2,994	29,000	1,2-Dichloroethane	25,816	320,000	Chromium	21.6	251	Eldrin	180	180
1,2-Dichlorobenzene	16,884	130,000	2-Butanone	75	240	Cobalt	3.4	13	Heptachlor	16	27
2-Methyl Phenol	498	4,300	1,1,1-Trichloroethane	1,603	6,400	Copper	20	763			
bis(2-Chloroisopropyl)ether	460	460	1,2-Dichloropropane	2	3	Lead	6.9	56			
4-Methylphenol	722	3,400	Trichloroethene	5,840	35,000	Mercury	0.2	1.4			
N-Nitroso-dipropylamine	723	1,400	Benzene	7,657	50,000	Nickel	4.2	19			
Isophorone	9,276	130,000	2-Hexanone	61	76	Silver	1	1			
2,4-Dimethylphenol	157	1,100	4-Methyl-2-Pentanone	2,577	73,000	Vanadium	15.2	94			
Benzoic Acid	5,209	19,000	1,1,2-Trichloroethane	2	2	Zinc	28.9	278			
2-4-Dichlorophenol	7,408	46,000	Tetrachloroethene	25,595	270,000						
1,2,4-Trichlorobenzene	918	2,900	Toluene	260,011	3,200,000						
Naphthalene	7,437	53,000	Chlorobenzene	1,847	16,000						
4-Chloroaniline	2,000	2,000	Ethylbenzene	64,408	1,200,000						
4-Chloro-3-Methlylphenol	6,000	6,000	Styrene	169,897	2,300,000						
2-Methylnaphthalene	2,726	16,000	Total Xylenes	269,534	5,400,000						
2,4,6-Trichlorophenol	370	370	2-Chloroethyl Vinyl Ether	21,000	21,000						
2-Chloronaphthalene	3,185	12,000									
Dimethyl Phthalate	687	1,200									
Acenaphthlene	112	220									
2,4-Dichlorophenol	7,408	46,000									
4-Nitrophenol	9,035	18,000									
Dibenzofuran	250	250									
2,4-Dinitrotoluene	2,800	2,800									
Diethyl Phthalate	866	4,300									
Flourene	140	220									
N-Nitroso-Diphenylamine	14,885	23,000									
Pentachlorophenol	2,033	4,000									
Phenanthrene	577	1,400									
Anthracene	48	55									
Di-n-butyl Phthalate	1,734	6,800									
Flouranthene	369	500									
Pyrene	287	460									
Butyl benzyl phthalate	1,059	7,200									
Benzo(a)Anthracene	213	340									
Chrysene	169	360									
bis(2-ethylhexyl)phthalate	29,290	470,000									
Di-n-octyl Phthalate	1,632	5,100									
Benzo(b)flouranthene	475	700									
Benzo(k)flouranthene	475	700									
Benzo(a)pyrene	126	240									

Chestnut Branch Marsh Soils

		(Dup of GP-1)							
(µg/kg)	GP-1	GP-16	GP-2	GP-3	GP-4	GP-5	GP-6	GP-7	GP-8
VOLATILES									
Methylene Chloride		2J	7J	4*	5J		6J		4J
Acetone			170			170*			
Benzene						6J			
Toluene						1J			
Ethylbenzene						8*			
SEMIVOLATILES									
N-Nitrosodiphenylamine	560B	440*	1200B	650B	840B	1800B	1400B	870*	1300B
Di-n-butyl pthalate	1100*	1500*	1800*	2300*	2800*	2200*	1800*		1600*
Hexachlorobenzene		120*							
bis(2-Ethylhexyl)phthalate		130*	280J	160*	160*	370J	700J	190B	660B
Pyrene			160J						
BCCE					5900	2100	1600		7400
1-2 Dichlorobenzene					210J				
Naphthalene					260J				
bis(2-Chloroethoxy)ethane					7700J	3300J	2300J		9500J
Phenanthene									280J
Flouranthene									310J
Pyrene									400J
Benzo(a)anthacene									240J
Benzo(b)flouranthene									300J
4-4-DDE			97	22		110			140
4-4-DDD			150			68			610

Chestnut Branch Marsh Soils

(µg/kg)	GP-9	GP-10	DUP GP-10	GP-11	GP-12	GP-13	GP-14	GP-15
VOLATILES								
Methylene Chloride	4J	27*	37*	9*	5*	5*	19*	4*
Acetone		16*	49*	9*	4*	13	11*	2*
Chloroform		9	12	4J	3J	14	9	3J
1,2-Dichloroethane		99	72					
Tetrachloroethene		3J						
Toluene		3J	6			6	2J	
1,1-Dichloroethane		10	4J					
Trichoroethene		3J	5			4J		
trans-1,2-Dichloroethene			7					
Benzene						1J		
Total Xylenes						3J		
SEMIVOLATILES								
bis(2-chloroethyl)ether		60J	83J			3700		
2-Methylnaphthalene						34J	15J	
N-Nitrosodiphenylamine	450*							
Di-n-butylphthalate	1300*	10*	59*	30*		93*	50*	22*
bis(2-Ethylhexyl)phthalate	130J	300*	420*			560*	630B	120*
bis(2-Chloroethoxy)ethane	68J					5100J		
Naphthalene		5J	9J	2J	3J	47J	19J	
Di-n-Octyl Phthalate		430*	130*	230*	560*	530*	240*	120*
Isophorone			7J			6J		
Benzoic Acid						130J		
Acenaphthalene						52J	21J	
Acenaphthylene						190J	38J	
Dibenzofuran						31J	12J	
Flourene						200J	65J	
Phenanthrene						1500	560	
Anthracene						230J	64J	
Flouranthene						2400	750	
Pyrene						1600	550	
Benzo(a)Anthracene						870	320J	
Chrysene						1200	400	
Benzo(b)Flouranthene						1400	270J	
Benzo(k)Flouranthene						170J	54J	
Benzo(a)Pyrene						860	280J	
Ideno(1,2,3-cd)Pyrene						650	200J	
Benzo(g,h,i)Perylene						750	240J	

Chestnut Branch Marsh Soils

(mg/kg)	GP-1	GP-16	GP-2	GP-3	GP-4	GP-5	GP-6	GP-7	GP-8	GP-9	GP-10	GP-17	GP-11	GP-12	GP-13	GP-14	GP-15
Arsenic	3.1*	1.5*	48*	14.2	2.6*	10.9*	7.1*	1.5*	15.2*	1.2*	2.3*	2.4*	2.3*	2.4*	65.5*	3.3*	
Barium	20	15	104	61	21	73	48		114			19	101	13	120	24	
Beryllium																	
Cadmium	•																
Chromium	13*	11*	24*	23*	6.3*	19*	12*	8.9*	66*	2.6*	3.4*	6.8*	9.9*	18*	96*	21*	67*
Copper			20	12		18			20				4.8		74	10	
Lead	14*	8.7*	244	40	17*	96	48	4.3*	256	13.7*	16	23	6.7*	5.2*	424	80	2.5*
Mercury					0.14	0.3	0.2		0.5						0.5	0.13	
Nickel			8.7	6.4					16						16		
Selenium				•													
Silver																	
Thallium																	
Vanadium	12	11	28	20	7.7	26	22	5.9	33			8.1	12	27	39	11	
Zinc	73*	66*	174*	136*	55*	122*	59*	63*	154*	56*	54*	59*	96*	115*	325*	109*	68*

SE Sediments mg/kg

Chestnut Branch Marsh Soils

	CDM 1985										
(µg/kg)	WCB #1 (0)	DUP (0)	WCB #1 (2)	WCB #2 (0)	WCB #2 (2)	WCB #3 (0)	WCB #3 (2)	WCB #4 (0)	WCB #4 (2)	WCB #5 (0)	WCB #5 (2)
VOLATILES											
Methylene Chloride	24B	19B	30*	15*	42*	17*	6*	22*	11*	14*	3*
Acetone	330	820	18	37	87	130	44	180	87	200	24
Carbon Disulfide	33	33			11	24	6J				
4-Methyl-2-Pentanone	19			2J	7J	6J	6J		13		
Xylene (Total)			40B	34*	600B	5*	69B	310		69	
Benzene				2J	9	100	1J	94		97	
Chlorobenzene				22	4J						
Ethylbenzene					110	10	20	160		110	
1,1-Dichloroethane					3J						
SEMIVOLATILES											
bis(2-Ethylhexyl)phthalate	300J		170J	150J	170J						
1,2-Dichlorobenzene		180*			410JB	220*	130*	170*			
Pyrene			83J								
Naphthalene				76*	230J		850				
bis(2-Chloroethyloxy)ethane				2370T	5040T	710T		170J	6310T		7930T
BCEE							3400*		5500		
INORGANICS (mg/kg)											
Arsenic	16	41	12	27						16	
Cadmium								34	3		9
Chromium	16	14		11				31		18	22
Iron	16900	32900	11100	20100	4680	109000	4100	174000	2970	18100	22000
Lead	65	254	61	154	6.1	18	2.6	210	6.7	241	184
Mercury		0.28		0.2						0.3	0.24
Nickel		95	32	71		78	39	112	26	49	46
Zinc	65	55	52	107	16		10	256		31	98

(0) Sample taken from 0-6 inches below surface.
(2) Sample taken from 18-24 inches below surface.

Leachate Liquid

(μg/l)

VOLATILE	S & A 8/79 1	2	3	4	S & A 10/79 3	5	6	Hart 1982
Chloromethane								
Bromomethane								
Vinyl Chloride	12	17	64		58			
Chloroethane	5.2				26	3.2		
Methylene Chloride	6	57	0.7	12	2890	110	28	4,300
Acetone								
Carbon Disulfide								
1,1-Dichloroethene			0.4		4.4			
1,1-Dichloroethane	36	150	97	6	129	5.2		
1,2-Dichloroethene		2.4			28			
Chloroform								
1,2-Dichloroethane					1,338	123	43	8,900
2-Butanone								
1,1,1-Trichloroethene								
Carbon Tetrachloride								
Vinyl Acetate								
Bromodichloromethane								
1,2-Dichloropropane								
cis-1,3-Dichloropropane								
Trichloroethene			2.5		23	0.2		
Dibromochloromethane								
1,1,2-Trichloroethane								
Benzene	1456	2012	1605	171	1,190	100	9.8	1,200
trans-1,3-Trichloroethane								
Bromoform								
4-Methyl-2-Pentanone								
2-Hexanone								
Tetrachlorethene								
1,1,2,2,-Tetrachlorethane								
Toluene	14400	22,000	15500	1530	12,700	622	51	9,200
Chlorobenzene	4.3	9.5	5.0	1.2	2.8	0.7	0.1	
Ethylbenzene	706	1100	684	82	580	62	3.4	1,000
Styrene								
Xylenes (Total)								

Leachate Liquid (μg/l)

VOLATILE	TAGA Nov-87 Z1	Z2	Z3	Z4	Z5	Z6
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane				6J		
Methylene Chloride	750	920B				
Acetone	7400	8700	28	150		
Carbon Disulfide	51J		15	16	5	42
1,1-Dichloroethene						
1,1-Dichloroethane	1J					
1,2-Dichloroethene	6					
Chloroform						
1,2-Dichloroethane	1200	1100				
2-Butanone		540		60		
1,1,1-Trichloroethane						
Carbon Tetrachloride						
Vinyl Acetate						
Bromodichloromethane						
1,2-Dichloropropane						
cis-1,3-Dichloropropane						
Trichloroethene						
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene	450J	1100	21	610	41	2J
trans-1,3-Triochloroethane						
Bromoform						
4-Methyl-2-Pentanone	11000	22000	22	14		
2-Hexanone						
Tetrachloroethene						
1,1,2,2,-Tetrachloroethane						
Toluene	650	7600	20	6		
Chlorobenzene				54	56	5
Ethylbenzene	4J	180	2J	100	5	
Styrene						
Xylene (Total)	1J	620	4J	150	16	1J

Leachate Liquid (µg/l)

	TAGA Jun 86							TAGA Aug 1986						TAGA Sep-86					
VOLATILE	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z1	Z2	Z3	Z4	Z5	Z6	Z1	Z2	Z3	Z4	Z5	Z6
Chloromethane	4J	19																	
Bromomethane																			
Vinyl Chloride																			
Chloroethane				32							15.3	15.4J					24	6	
Methylene Chloride	500 B	4600B		300B				1267*	3366*		741*			300J	2200		200		7
Acetone	15000	17000		3100	24B	20B		12928*	9936*	524*	2095*			21000	14000		1300		6J
Carbon Disulfide				33J						6J		18					25	4J	
1,1-Dichloroethene									137*				1J						
1,1-Dichloroethane									137*			3.6J							
1,2-Dichloroethene		5200							72*				3.1J						
Chloroform														2J			2		
1,2-Dichloroethane								656	1525*	12.4J			6.4						12
2-Butanone								822*	2086*	46.3	503				3500*			2J	6J
1,1,1-Trichloroethane																			6J
Carbon Tetrachloride														100J			300J		
Vinyl Acetate																			
Bromodichloromethane																			
1,2-Dichloropropane																			
cis-1,3-Dichloropropene																			
Trichloroethene																			
Dibromochlromethane																			
1,1,2-Trichloroethane																			
Benzene	200J	1000		3900	80	190		109J	1110*	3.2J	2789	273	192	200J	800		2500	8	
trans-1,3-Triochloroethane																			
Bromoform																			
4-Methyl-2-Pentanone	12000	18000		5700				8617	24319*		4330			20000			300		
2-Hexanone		6J															24		
Tetrachloroethene																			
1,1,2,2,-Tetrachloroethane																			
Toluene	860	4800		8900	17B			434	7275*		4261			400J	4600		3200		
Chlorobenzene				8	36	9				5.2J	65J	67.3	41					17	
Ethylbenzene		6		900	130			2.8J	194*	39.5	624	71.8	19	50J	200		500		
Styrene																			
Xylenes (Total)	200	600		3800	240	6		8.9	704*	118	1628	117	4.5J	50J	700		1400	4J	

Leachate Liquid
(µg/l)

	S & A							S & A			Hart
	9-Aug-79			22-Aug-79				10 Oct 79			1981
SEMIVOLATILE	1	2	3	1	2	3	4	3	5	6	
Phenol								2,400	5,900	490	
bis(2-chloroethyl)ether	44,000	38,000	76,000		130,000	210,000	54,000	230,000	29,000	14,000	52,000
2-Chlorophenol											
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
Benzyl Alcohol											
1,2-Dichlorobenzene											
2-Methyl Phenol											
bis(2-chloroisopropyl)ether											
4-Methylphenol											
N-Nitroso-Di-n-Propylamine											
Hexachloroethane											
Nitrobenzene											
Isophorone											
2-Nitrophenol											
2,4-Dimethylphenol											
Benzoic Acid											
bis(2-chloroethoxy)ethane											
2-4-Dichlorophenol											
1,2,4-Trichlorobenzene											
Naphthalene											
4-Chloroaniline					94	49		46	5.7	30	
Hexachlorobutadiene											
4-Chloro-3-Methylphenol											
2-Methylnaphthalene											
Hexachlorocyclopentadiene											
2,4,6-Trichlorophenol											
2,4,5-Trichlorophenol											
2-Chloronaphthalene											
2-Nitroaneline											
Dimethyl Phthalate											
Acenaphthylene											
3-Nitroaneline											

Leachate Liquid (μg/l)

SEMIVOLATILE	TAGA June 1986						TAGA August 1986						TAGA Sep-86					
	Z1	Z2	Z3	Z4	Z5	Z6	Z1	Z2	Z3	Z4	Z5	Z6	Z1	Z2	Z3	Z4	Z5	Z6
Phenol							1631*	9468*		314*		12J	1500	8600				
bis(2-chloroethyl)ether	4400	3200		4500	3400	4000	11883*	27852*	132*	11471*	9847*	9364*	6000	12000		1500	490	300
2-Chlorophenol																		
1,3-Dichlorobenzene																		
1,4-Dichlorobenzene																		
Benzyl Alcohol														120J				
1,2-Dichlorobenzene									42*	2.9J		3.5J				8		18J
2-Methyl Phenol																		
bis(2-chloroisopropyl)ether																		
4-Methylphenol	360													1100				
N-Nitroso-Di-n-Propylamine																		
Hexachloroethane																		
Nitrobenzene																		
Isophorone		160J								13.8J			80J	80		18	4J	
2-Nitrophenol																		
2,4-Dimethylphenol																		
Benzoic Acid																		
bis(2-chloroethoxy)ethane	3390J	1480J					26000J	38800J				77J						
2-4-Dichlorophenol																		
1,2,4-Trichlorobenzene																		
Naphthalene		340		500												150		18J
4-Chloroaniline																		
Hexachlorobutadiene																		
4-Chloro-3-Methlylphenol																		
2-Methylnapthalene																		
Hexachlorocyclopentadiene																		
2,4,6-Trichlorophenol																		
2,4,5-Trichlorophenol																		
2-Chloronaphthalene																		
2-Nitroanaline																		
Dimethyl Phthalate																		
Acenaphthylene																		
3-Nitroanaline																		

Leachate Liquid (µg/l)

SEMIVOLATILE	TAGA November 1987 Z1	Z2	Z3	Z4	Z5	Z6
Phenol	1600	2600	540	29J		4J
bis(2-chloroethyl)ether	8400	5500	2200	6300	5100	66
2-Chlorophenol						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
Benzyl Alcohol	3J			6J		
1,2-Dichlorobenzene				180J		3J
2-Methyl Phenol	33	88				
bis(2-Chloroisopropyl)ether						
4-Methylphenol	130	370	260	6J		
N-Nitroso-Di-n-Propylamine						
Hexachloroethane						
Nitrobenzene						
Isophorone	190	150		19J	5J	
2-Nitrophenol						
2,4 Dimethylphenol				8J		
Benzoic Acid	2000	11000	780			
bis(2-chloroethoxy)ethane						
2-4-Dichlorophenol						
1,2,4-Trichlorobenzene						
Naphthalene		12J	50J	4200	26	
4-Chloroaniline				670	7J	
Hexachlorobutadiene						
4-Chloro-3-Methylphenol						
2-Methylnaphthalene				420J		
Hexachlorocyclopentadiene						
2,4,6-Trichlorophenol						
2,4,5-Trichlorophenol						
2-Chloronaphthalene						
2-Nitroanaline						
Dimethyl Phthalate						
Acenaphthylene						
3-Nitroanaline						

Leachate Liquid
(µg/l)

SEMIVOLATILE	S & A 9/79 1	2	3	22-Aug-79 1	2	3	4	S & A 10/10/79 3	5	6	TAGA June 1986 Z1	Z2	Z3	Z4	Z5	Z8
Acenaphthene																
2,4-Dinitrophenol																
4-Nitrophenol																
Dibenzofuran																
2,4-Dinitrotoluene																
2,6-Dinitrotoluene																
Diethylphthlate								28	9.5							
4-Chlorophenyl-phenylether																
Flourene																
4-Nitroaniline																
4,6-Dinitro-2-Methylphenol																
N-Nitrosodiphenylamine																
4-Bromophenyl-phenylether																
Hexachlorobenzene																
Pentachlorophenol																
Phenanthrene																
Anthracene																
Di-n-butyl phthalate				9.5	10				0.8	0.8						
Flouranthene									0.7	0.6						
Pyrene									0.8	0.6						
Butylbenzylphthalate																
3,3'-Dichlorobenzene																
Benzo(a)Anthracene																
bis(2-Ethylhexyl)phthalate					97			11	106	14						
Chrysene																
Di-n-octyl Phthalate									6							
Benzo(b)Flouranthene																
Benzo(k)Flouranthene																
Benzo(a)Pyrene																
Indeno(1,2,3-cd)Pyrene																
Dibenzo(a,h)Anthracene																
Benzo(g,h,i)Perylene																

Leachate Liquid (μg/l)

	TAGA Aug 86						Nov 87					
	Z1	Z2	Z3	Z4	Z5	Z6	Z1	Z2	Z3	Z4	Z5	Z6
Acenaphthene												
2,4-Dinitrophenol												
4-Nitrophenol												
Dibenzofuran												
2,4-Dinitrotoluene												
2,6-Dinitrotoluene												
Diethylphthalate												
4-Chlorophenyl-phenylether												
Flourene												
4-Nitroanilline												
4,6-Dinitro-2-Methylphenol												
N-Nitrosodiphenylamine												
4-Bromophenyl-phenylether												
Hexachlorobenzene												
Pentachlorophenol												
Phenanthrene												
Antheacene												
Di-n-butyl pthalate						60J			8J			
Flouranthene												
Pyrene												
Butylbenzylphtalate												
3,3'-Dichlorobenzene												
Benzo(a)Anthracene												
bis(2-Ethylhexyl)phthalate								320J	130J			
Chrysene												
Di-n-octyl Phthalate												
Benzo(b)Flouranthene												
Benzo(k)Flouranthene												
Benzo(a)Pyrene												
Indeno(1,2,3-cd)Pyrene												
Dibenzo(a,h)Anthracene												
Benzo(g,h,i)Perylene												

Leachate Liquid

(μg/l)

	S & A 9 Aug 1979			S & A 22 Aug 1979				S & A 10 Oct 79		
	1	2	3	1	2	3	4	3	5	6
Arsenic				8J	20J	19	27			
Barium										
Beryllium					2J					
Cadmium					53	9	6J			
Chromium				40J	130	30J	50J	10		20
Copper				110	130	110	95	120	30	46
Lead					640	100J	260	60	80	380
Mercury										
Nickel				30	40J	20J		5		6
Selenium										
Silver										
Thallium										
Vanadium										
Zinc				96	400	257	180	40		48

Leachate Liquid

(µg/l)

	TAGA Jun-86 Z1	Z2	Z3	Z4	Z5	Z6	TAGA Aug-86 Z1	Z2	Z3	Z4	Z5	Z6	TAGA Sep-86 Z1	Z2	Z3	Z4	Z5	Z6
Arsenic	106	228		67	29		26	10.3			14*		100	90*		14	60	
Beryllium	302	30J *		13J	15J	10J	13	4		5	32	27	97	50				
Cadmium	159J	91J		157J	219J	292J	16	29		77	423	364						
Chromium	1670J	710J		786J									1350	700			680	90
Copper	1920J	491J		3055	806J	870J	77*	138*		191*	1205*	1167*	1130	580				
Lead	12000	1890		1140	976	382	456	998		705	5889	2350	9040	2460		270	3920	218
Mercury	1.5	0.5		0.7	0.3	0.4							1.2*					
Nickel	257J	68J		477J				45			1250	99	400	200			1110	
Selenium																		
Silver							438J											
Vanadium	2070	1110		141J			114	246		123	896	380	1370	1180		310	1490	310
Zinc	6690J	1160		1050J	828J	755J	326	666		350*	3940*	1300*	4300	2570		1070	4010	240

Leachate Liquid (µg/l)

	TAGA November 1987 Z1	Z2	Z3	Z4	Z5	Z6
Arsenic						
Barium						
Beryllium	23*	39	1.1	15	37	17
Cadmium	82*	364*	8*	136*	412*	432*
Chromium	1060*	730*	53*	110*	225*	126*
Copper	923*	655*	88*	225*	380*	193*
Lead	6270	3970	388	1510	2360	1410
Mercury	3.0*	1.7*	1.5*	0.8*	1.6*	1.7*
Nickel	291	125	31	48	104	74
Selenium						
Silver						
Thallium						
Vanadium	947*	1610*	58*	1970*	3660*	2716*
Zinc	4900*	2160*	384*	1085*	2610*	1050*

Chestnut Branch Stream

	S & A 9/79 Water (µg/l)		Radian 1982	CDM 1985							
VOLATILE *	1	2	SW	SW1	SW5	SW3	SW4	SE1	SE5	SE3	SE4
Chloromethane											
Bromomethane											
Vinyl Chloride											
Chloroethane											
Methylene Chloride				5J		2*	2*	620B		490B	
Acetone				9B		21*	10*	72B		81B	120
Carbon Disulfide											
1,1-Dichloroethene											
1,1-Dichloroethane											
1,2-Dichloroethene											
Chloroform											
1,2-Dichloroethane											
2-Butanone						17*	19*			10	
1,1,1-Trichloroethane			3						1.3J		
Carbon Tetrachloride											
Vinyl Acetate											
Bromodichloromethane											
1,2-Dichloropropane											
cis-1,3-Dichloropropane											
Trichloroethene	0.8										
Dibromochlromethane											
1,1,2-Trichloroethane											
Benzene						5J		8.6J		9.7B	
trans-1,3-Triochloroethane											
Bromoform											
4-Methyl-2-Pentanone											
2-Hexanone											
Tetrachlroethene											
1,1,2,2,-Tertrachlroethane											
Toluene				5J		5*	5*				
Chlorobenzene											
Ethylbenzene											
Styrene											
Xylenes (Total)											

SW Surface Water µg/l
SE Sediment µg/kg

Chestnut Branch Stream

VOLATILE*	EPA/ERT 3/88 S1		S2		S3		S4		S9		S10		S11	
	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE
Chloromethane										6J				
Bromomethane														
Vinyl Chloride														
Chloroethane														
Methylene Chloride	12			16B	13	15		45B					12	16
Acetone														
Carbon Disulfide														
1,1-Dichloroethene														
1,1-Dichloroethane														
1,2-Dichloroethene														
2-Butanone														
1,1,1-Triochloroethane														
Carbon Tetrachloride														
Vinyl Acetate														
Bromodichloromethane														
1,2-Dichloropropane														
cis-1,3-Dichloropropane														
Trichloroethene														
Bromochloromethane														
1,1,2-Trichloroethane														
Benzene														
trans-1,3-Trichloroethane														
Bromoform														
4-Methyl-2-Pentanone														
2-Hexanone														
Tetrachloroethene														
1,1,2,2,-Tetrachloroethane														
Toluene	2J					30B		37B						
Chlorobenzene														
Ethylbenzene				160J										
Styrene														
Xylenes (Total)				45J										

SW Surface water μg/l
SE Sediments

Chestnut Branch Stream

*	S & A 9/79 Surface		Hart 1981		Ra an 1982		CDM 1985							
SEMIVOLATILE	1	2	SW1	SW2	SW	SE	SW1	SW5	SW3	SW4	SE1	SE5	SE3	SE4
Phenol			250	280	68									
bis(2-chloroethyl)ether		890							20J	11				
2-Chloro [illegible]														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Benzyl Alcohol														
1,2-Dichlorobenzene														
2-Methyl Phenol														
bis(2-Chloroisopropyl)ether														
4-Methylphenol														
N-Nitroso-Di-n-Propylamine														
Hexachloroethane														
Nitrobenzene														
Isophorone														
2-Nitrophenol														
2,4-Dimethylphenol									20J					
Benzoic Acid													122J	460J
bis(2-Chloroethoxy)ethane									14	17				
2-4-Dichlorophenol														
1,2,4-Trichlrobenzene														
Naphthalene														21J
4-Choroaniline														
Hexachlorobutalene														
4-Chloro-3-Methlylphenol														
2-Methylnapthalene														14J
Hexachlorocyclopentadiene														
2,4,6-Trichlorophenol														
2,4,5-Trichlorophenol														
2-Chloronapthalene														
2-Nitronanaline														
Dimethyl Phthalate														22J
Acenaphthylene														
3-Nitroanaline														

SW Surface Water µg/l
SE Sediment µg/kg

Chestnut Branch Stream

SEMIVOLATILE	EPA/ERT 3/88 S1 SW	SE	S2 SW	SE	S3 SW	SE	S4 SW	SE	S9 SW	SE	S10 SW	SE	S11 SW	SE
Phenol														
bis(2-chloroethyl)ether					3J	41	4J	47	13J		8J			
2-Chlorophenol														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Benzyl Alcohol														
1,2-Dichlorobenzene														
2-Methyl Phenol														
bis(2-Chloroisopropyl)ether														
4-Methylphenol														
N-Nitroso-Di-n-Propylamine														
Hexachloroethane														
Nitrobenzene														
Isophorone														
2-Nitrophenol														
2,4-Dimethylphenol														
Benzoic Acid														
bis(2-Chloroethoxy)ethane									10J					
2-4-Dichlorophenol														
1,2,4-Trichlorobenzene														
Naphthalene										12J				
4-Chloroaniline														
Hexachlorobutadiene														
4-Chloro-3-Methlylphenol														
2-Methylnaphthalene														
Hexachlorocyclopentadiene														
2,4,6-Trichlorophenol														
2,4,5-Trichlorophenol														
2-Chloronaphthalene														
2-Nitronanaline														
Dimethyl Phthalate														
Acenaphthylene														
3-Nitroanaline														

SW Surface Water µg/l
SE Sediments µg/kg

Chestnut Branch Stream

•	S & A 9/79 Water (µg/l)		Sediment		Radian 1982		CDM 1985							
SEMIVOLATILE	1	2	1	2	SW	SE	SW1	SW5	SW3	SW4	SE1	SE5	SE3	SE4
Acenapthene									20J					20J
2,4-Dinitrophenol														
4-Nitrophenol														
Dibenzofuran														
2,4-Dinitrotoluene														
2,6-Dinitrotoluene														
Diethylphthalate														
4-Chlorophenyl-phenylether														
Flourene														47J
4-Nitroar														
4,6-Dinitro-2-Methylphenol														
N-Nitrosodiphenylamine														
4-Bromophenyl-phenylether														
Hexachlorobenzene														
Pentachlorophenol														
Phenanthrene			66	10							31J	100J	42J	590J
Anthracene			66	10										180J
Di-n-butyl phthalate	0.6	0.5	170	160		500								
Flouranthene			61	8							67J		41J	
Pyrene			48									190J		560J
Butylbenzylphthalate														
3,3'-Dichlorobenzene														
Benzo(a)Anthracene														
bis(2-Ethylhexyl)phthalate	0.5	0.3			17	3,000								56,000B
Chrysene			55											560J
Di-n-octyl Phthalate						1,000					96J	180J	168J	
Benzo(b)Flouranthene														11,000
Benzo(k)Flouranthene														11,000
Benzo(a)Pyrene			87											
Indeno(1,2,3-d)Pyrene														340J
Dibenzo(a,h)Anthracene														
Benzo g,h,i)Perylene														390J

SW Surface Water µg/l

SE Sediments µg/kg

Chestnut Branch Stream

	ERT/EPA March 1988													
	S1		S2		S3		S4		S9		S10		S11	
SEMIVOLATILE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE
Acenapthene										39				
2,4-Dinitrophenol														
2,4-Nitrophenol														
Dibenzofuran														
2,4-Dinitrotoluene														
2,6-Dinitrotoluene														
Diethylphthalate						90								
4-Chlorophenyl-phenylether														
Flourene						32			48					
4-Nitroaniline														
4,6-Dinitro-2-Methylphenol														
N-Nitrosodiphenylamine														
4-Bromophenyl-phenylether														
Hexachlorobenzene														
Pentachlorophenol														
Phenanthrene		24		79		250		73		410		190		180
Anthracene						40				65		32		61
Di-n-butyl phthalate												88		
Flouranthene		29		150		430		120		700		380		330
Pyrene		27		100		270		88		450		240		210
Butylbenzylphthalate				53								880		
3,3'-Dichlorobenzene														
Benzo(a)Anthracene										210		120		100
bis(2-Ethylhexyl)phthalate	94B	100		180		230	210B	250	110B	180		1000	84B	95
Chrysene				76		190			60	250		160		120
Di-n-octyl Phthalate		150B		290B		200B		640B		330B		190B		170B
Benzo(b)flouranthene				100				86		320				89
Benzo(k)flouranthene						140				79				
Benzo(a)Pyrene				56		130		49		190		110		
Indeno(1,2,3-d)Pyrene				36		85		13J		60		79		61
Dibenzo(a,h)Anthracene														
Benzo(g,h,i)Perylene				41		100		21		70				

SW Surface Water µg/l
SE Sediments µg/kg

Chestnut Branch Stream

	S & A 9/79				Fred C. Hart	Radian 1982		CDM 1985							
	Water ((µg/l)		Sediment (mg/kg)		1981			(µg/l)					(mg/kg)		
	1	2	1	2	SW	SW	SE	SW1	SW5	SW3	SW4	SE1	SE5	SE3	SE4
Arsenic			1.5	0.7											
Barium					84		1,000								
Beryllium							12						3	4.4	11
Cadmium		*	0.8	0.5	0.3									2	2.5
Chromium		3J	4.7	3.0			3,300			5.6	4.3*	6	8	14	84
Copper	14	13	1.6	1.7	5.0		3,600				2.8	3.4	5.3	119	
Lead			11	11	2.5			17*		13	16	11	129*	34*	820
Mercury			0.2	0.3										0.15	1.4
Nickel				1J	26		1,400	14		13	12			11	
Selenium					10										
Silver					10					6*	6*				
Thalium				1.8				2.3		5.6	4.4	2.4	3		
Vanadium							2,700	55*		21	15*	10	18	13	75
Zinc	6J		8	12	22		19,000						33	436	

Chestnut Branch Stream

	ERT/EPA March 1988													
	S1		S2		S3		S4		S9		S10		S11	
	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE	SW	SE
Arsenic				.5B		.5B		.74B		1.14		.41B		
Barium														
Beryllium				.08B		.1B		.16B		.11B		.12B		.08B
Cadmium														
Chromium	881	.9B		4.6	952	7.3	811	5.3	1470	4.3		4.4	875	2.3
Copper	23	2.7B		4.1	11B	5.1	11B	5.6	7.4B	5.3		6.0	6.1B	2.0
Lead	2.8	4		25	2.3B	20	2.2B	18	14	96		62	7.1	9.3
Mercury														
Nickel	6.1	.8B		1.2B		1.5B	7.4B	2.1B	8.4B	2.9B		3.2B		1.6B
Selenium	1.88	0.8B			.8B									
Silver														
Thalium														
Vanadium														
Zinc	61	7.1		17	20	22	22	22	21	28		36	13	12

SW Surface water µg/l
SE Sediments mg/kg

Rabbit Run SW & SE

VOLATILE	S & A 8/79 Water (µg/l) 1	2	Hart 1981 Water	Radian 1982 Water	CDM 1985 SW6	SE6	SW7	SE7	SW8	SE8
Chloromethane										
Bromomethane										
Vinyl Chloride										
Chloroethane		2.0								
Methylene Chloride	1.7	9.8				56*	5J		5J	46*
Acetone					34*	140B		22	11*	68*
Carbon Disulfide										
1,1-Dichloroethene										
1,1-Dichloroethane		8.5		1.9						
1,2-Dichloroethene										
Chloroform										
1,2 Chloroethane										
2-Butanone							19*		38*	
1,1,1-Trichloroethane						2.9J				2.1J
Carbon Tetrachloride										
Vinyl Acetate										
Bromodichloromethane										
1,2-Dichloropropane										
cis-1,3-Dichloropropane										
Trichoroethene										
Dibromochloromethane										
1,1,2-Trichloroethane										
[illegible]				31		1.4*		1.2*		2.6*
trans-1,3-Trichloroethane										
Bromoform										
4-Methyl-2-Pentanone										
2-Hexanone										
Tertrachlroethene										
1,1,2,2,-Tetrachloroethane										
Toluene		544		12				1.0*		35*
Chlorobenzene										
Ethylbenzene		26								
Styrene							5J			
Xylenes (Total)										

SW Surface Water µg/l
SE Sediment µg/kg

Rabbit Run

SEMIVOLATILE	S & A 8/79 Water (μg/l) 1	 2	Hart 1981 Water	Radain 1982 Water	CDM 1985 SW6	 SE6	 SW7	 SE7	 SW8	 SE8
Phenol		280	72							
bis(2-chloroethyl)ether	* 2300	13000	4,600	103			87		31	250J
2-Chlorophenol										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
Benzyl Alcohol										
1,2-Dichlorobenzene										
2-Methyl Phenol										
bis(2-chloroisopropyl)ether										
4-Methylphenol										360*
N-Nitroso-Di-n-Propylamine										
Hexachloroethane										
Nitrobenzene										
Isophorone										
2-Nitrophenol										
2,4-Dimethylphenol										
Benzoic Acid										200*
bis(2-Chloroethoxy)ethane				140			19J		16J	18J
2-4-Dichlorophenol										
1,2,4-Trichlorobenzene										
Naphthalene		1.9	11			280				
4-Chloroaniline										
Hexachlorobutadiene										
4-chloro-3-Methylphenol										
2-Methylnaphthalene										
Hexachlorocyclopentadiene										
2,4,6-Trichlorophenol										
2,4,5-Trichlorophenol										
2-Chloronaphthalene										
2-Nitroanaline										
Dimethyl Phthalate										
Acenaphthylene										
3-Nitroanaline										

Rabbit Run

	S & A 8/79 Water (µg/l)		Hart 1981	Radian 1982 Water	CDM					
	1	2			SW6	SE6	SW7	SE7	SW8	SE8
Acenaphthene										
2,4-Dinitrophenol										
2,4-Nitrophenol										
Dibenzofuran										
2,4-Dinitrotoluene										
2,6-Dinitrotoluene										
Diethylphthalate	1.4	1.0				77B				89J
4-Chlorophenyl-phenylether										
Flourene						38J				
4-Nitroaniline										
4,6-Dinitro-2-Methylphenol										
N-Nitrosodiphenylamine										20*
4-Bromophenyl-phenylether										
Hexachlorobenzene										
Pentachlorophenol										
Phenanthrene						250J				
Anthracene						68J				
Di-n-butyl phthalate	0.6	1.6		4		110J	10*			65*
Flouranthene						490				
Pyrene						520				
Butylbenzylphthalate				2						
3,3'-Dichlorobenzene										
Benzo(a)Anthracene						150J				
bis(2-Ethylhexyl)phthalate	3.6	1.2		9		2,900B				3,700*
Chrysene						230J				
Di-n-octyl Phthalate										
Benzo(b)Flouranthene										
Benzo(k)Flouranthene										
Benzo(a)Pyrene						267J				4,500
Indeno(1,2,3-cd)Pyrene										
Dibenzo(a,h)Anthracene										
Benzo(g,h,i)Perylene										

Rabbit Run

	S & A 8/79 Water (µg/l) 1	2	Hart 1981 Water	Radian 1982 Water	CDM 1985 SW6	SE6	SW7	SE7	SW8	SE8
Arsenic	10J									
Beryllium			10		2		4.2	3.5		
Cadmium	8J	4J	0.6		6.7			2		
Chromium		110	13		14	12	5.8	3.9		4.2
Copper	23	23	7		25	6.5	6.5		8.7	1.5
Lead			3		82J	33J	12J	2.4	28J	38
Mercury								0.1		0.12
Nickel		20J	40	4	16					
Selenium			9							
Silver			12							
Thallium										
Vanadium			19		11	7.3	11	1.7	7.4	3.0
Zinc	22	10J	113		90	36	49	10	37	33

SW Surface Water µg/l
SE Sediments mg/kg

Alcyon Lake Surface Water

(µg/l)

VOLATILE	S & A Surface Water				Radian 1982	CDM 1985	TAGA 1986/87				EPA/ERT 3/88			
	1	2	3	4		SW10	SW1	SW2	SW3	SW4	L5	L6	L8	L9
Chloromethane									2100	1000				
Bromomethane														
Vinyl Chloride														
Chloroethane														
Methylene Chloride											8		18B	5B
Acetone							31		300B	300B				
Carbon Disulfide								16*	18000	4000				
1,1-Dichloroethene														
1,1-Dichloroethane														
1,2-Dichloroethene														
Chloroform														
1,2-Dichloroethane														
2-Butanone														
1,1,1-Trichloroethane					4									
Carbon Tetrachloride														
Vinyl Acetate														
Bromodichloromethane														
1,2-Dichloropropane														
cis-1,3-Dichloropropane														
Trichloroethene														
Dibromochloromethane														
1,1,2-Trichloroethane														
Benzene							20			100J				
trans-1,3-Trichloroethane														
Bromoform							64*	4B	11000	5900				
4-Methyl-2-Pentanone														
2-Hexanone														
Tetrachlroethene														
1,1,2,2,-Tertrachloroethane														
Toluene			0.9				500	500		900	1J		3B	
Chlorobenzene							6	3J						
Ethylbenzene														
Styrene														
Xylene (Total)							30	3						

Alcyon Lake Surface Water

(µg/l)

SEMIVOLATILE	S & A 1979 Surface Water 1	2	3	4	Hart 1981	Radian 1982	CDM 1985	TAGA/ERT 1986/87				EPA/ERT 3/88			
							SW10	SW1	SW2	SW3	SW4	L5	L6	L7	L8
Phenol						1.0		.3J							
bis(2-chloroethyl)ether	270	330	240	780	280	70	11	19J	14	930J	6.4J	19J			14J
2-Chlorophenol															
1,3-Dichlorobenzene															
1,4-Dichlorobenzene															
Benzyl Alcohol															
1,2-Dichlorobenzene															
2-Methyl Phenol															
bis(2-Chloroisopropyl)ether															
4-Methylphenol															
N-Nitroso-Di-n-Propylamine															
Hexachloroethane															
Nitrobenzene															
Isophorone															
2-Nitrophenol															
2,4-Dimethylphenol															
Benzoic Acid															
bis(2-chloroethoxy)ethane						73									
2-4-Dichlorophenol															
1,2,4-Trichlrobenzene															
Naphthalene															
4-Chloroaniline															
Hexachlorobutadiene															
4-Chloro-3-Methlylphenol															
2-Methylnapthalene															
Hexachlorocyclopentadiene															
2,4,6-Trichlorophenol															
2,4,5-Trichlorophenol															
2-Chloronaphthalene															
2-Nitroanaline															
Dimethyl Phthalate															
Acenaphthylene															
3-Nitroanaline															

Alcyon Lake Surface Water

(µg/l)

	S&A 1979				HART	Radian	TAGA/EPA				EPA/ERT					
SEMIVOLATILE	1	2	3	4	1981	198	SW1	SW2	SW3	SW4	L5	L5	L6	L7	L8	L8
Acenapthene																
2,4-Dinitrophenol																
4-Nitrophenol																
Dibenzofuran																
2,4-Dinitrotoluene																
2,6-Dinitrotoluene																
Diethylphthlate																
4-Chlorophenyl-phenylether																
Flourene																
4-Nitroaniline																
4,6-Dinitro-2-Methylphenol																
N-Nitrosodiphenylamine																
4-Bromophenyl-phenylether																
Hexachlorobenzene																
Pentachlorophenol																
Phenanthrene																
Anthracene																
Di-n-butyl phthalate	0.8	1.0	1.4	1.1		60		0.5J								
Flouranthene																
Pyrene																
Butylbenzylphthalate																
3,3'-Dichlorobenzene																
Benzo(a)Anthracene																
bis(2-Ethylhexyl)phthalate	0.5	0.6	1.6	5.5		170					120B	130B				
Chrysene																
Di-n-octyl phthalate																
Benzo(b)Flouranthene																
Benzo(k)Flouranthene																
Benzo(a)Pyrene																
Indeno(1,2,3-cd)Pyrene																
Dibenzo(a,h)Anthracene																
Benzo(g,h,i)Perylene																

Alcyon Lake Surface Water

(µg/l)

	S & A 1979				Hart 1981	Radian 1982	CDM 1985	TAGA/ERT 86/87				EPA/ERT 3/88			
	1	2	3	4			SW10	SW1	SW2	SW3	SW4	L5	L6	L7	L8
Arsenic				3J				7.6J							
Barium					78										
Beryllium							1.4	1.5J							
Cadmium					0.1					6.9*					
Chromium						9	6.7	34*				932			2190
Copper	13	13	12	13		17	5.0		28*	19*		9.0B			6.9B
Lead					33		17	234*	21*	125	12	10.2			8.7
Mercury							0.2	0.3J	0.3J	0.1J	0.2J				
Nickel				10J		100J						7.4			5.1B
Selenium					8							0.9B			
Silver	5.0J				5										
Thalium															
Vanadium						21		14*	13*	14J	14J				
Zinc	34			10J	49	3	17	31*	45*	26J	15	19.5			15

Alcyon Lake Sediments

(µg/kg)

	Radian 1982	CDM 1985								CDM 1986			EPA/ERT 3/88					
		B1		B2		B3		B4					L5	L5	L6	L7	L8	L8
VOLATILE		Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	SE19	SE20	SE21	Shallow	Deep			Shallow	Deep
Chloromethane																		
Bromomethane																		
Vinyl Chloride																		
Chloroethane																		
Methylene Chloride	120	25B	1700B	2800B	100B	290B	120B	27B	36*									58B
Acetone		40B	390B	6800*	130	1800	31B	17B	38*									
Carbon Disulfate									6J									
1,1-Dichloroethene																		
1,1-Dichloroethane																		
1,2-Dichloroethene																		
Chloroform						11J			3.2J									
1,2-Dichloroethane																		
2-Butanone				18000*														
1,1,1-Trichloroethane																		
Carbon Tetrachloride																		
Vinyl Acetate																		
Bromodichloromethane																		
1,2-Dichloropropane																		
cis-1,3-Dichloropropene																		
Trichoroethene																		
Bromochloromethane																		
1,1,2-Trichloroethane																		
Benzene	20																	
trans-1,3-Trichloroethane																		
Bromoform																		
4-Methyl-2-Pentanone					11J				600B									
2-Hexanone																		
Tetrachlroethene																		
1,1,2,2,-Tertrachlroethene																		
Toluene															40B	11B	14B	60B
Chlorobenzene																		
Ethylbenzene																		
Styrene																		
Xylene (Total)																		

Alcyon Lake Sediments

(μg/kg)

	CDM 1985								EPA/ERT MARCH 1988					
	B1		B2		B3		B4		L5	L5	L6	L7	L8	L8
	Shllw	Deep	Shllw	Deep	Shllw	Deep	Shllw	Deep	Shllw	Deep			Shllw	Deep
Phenol														
bis(2-chloroethyl)ether											400	64		42
2-Chlorophenol														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Benzyl Alcohol														
1,2-Dichlorobenzene														
2-Methyl Phenol							540*							
bis(2-Chloroisopropyl)ether														
4-Methylphenol							1200							
N-Nitroso-Di-n-Propylamine														
Hexachloroethane														
Nitrobenzene														
Isophorone														
2-Nitrophenol														
2,4-Dimethylphenol														
Benzoic Acid														
bis(2-Chloroethoxy)ethane														
2-4-Dichlorophenol														
1,7,4-Trichlorobenzene														
Naphthalene											37		12J	
4-Chloroaniline														
Hexachlorobutadiene														
4-Chloro-3-Methylphenol														
2-Methylnaphthalene														
Hexachlorocyclopentadiene														
2,4,6-Trichlorophenol														
2,4,5-Trichlorophenol														
2-Chloronaphthalene														
2-Nitronanaline														
Dimethyl Phthalate														
Acenaphthylene														
3-Nitroanaline														

Alcyon Lake Sediments

(µg/kg)

Semivolatile	S&A 1979 1	2	3	4	Hart 1981	CDM 1985 B1 Shllw	Deep	B2 Shllw	Deep	B3 Shllw	Deep	B4 Sllw	Deep	19	20	21	EPA/ERT L5 S	L5 D	L6	L7	L8 S	L8 D
Acenapthene		4.0		28													49					
2,4-Dinitrophenol																						
4-Nitrophenol																						
Dibenzofuran																						
2,4-Dinitrotoluene																						
2,6-Dinitrotoluene																						
Diethylphthlate																						
4-Chrlophenyl-phenylether																	30					
Flourene			29														57		110			
4-Nitroaniline																						
4,6-Dinitro-2-Methylphenol																						
N-Nitrosodiphenylamine																						
4-Bromophenyl-phenylether																						
Hexachlorbenzene																						
Pentachlorophenol																						
Phenanthrene	32	200	70	360	460	770J	1800			1500	300J	570	450	1300	550	780	320	75	780	550	300	
Anthracene	32	200	70	360	460												51	10J	92			
Di-n-butyl pthalate									280J													
Flouranthene	22	150	67	220	460	1600	2400	2300	430J	2400	460	870	640*	1400	620	1200	850	170	1700	1200	800	
Pyrene	15	140	60	170	500	1500	4400	1700	570J	2200	340*	960	400*	1400	600	850	560	110	1200	970	590	
Butylbenzylphtalate																						
3,3'-Dichlorobenzene																						
Benzo(a)Anthracene					1,200	840J	1600	770J		10000		410J	290J				290	47	590	420	290	
bis(2-Ethylhexyl)phthalate	34	44	240	46	1,000	710J	7500	5700	1800	5300	770	1600	1400*	1500	230J	1900	430	210	2200	2700	2300	
Chrysene		16		220	1,200	1100J	1700	1200	430J	1500	415*		370J	720	360J	650J	350	70	890	680	490	
Di-n-octyl Phthalate	92	260	64	300												330B	930B	450B	350B	890B		
Benzo(b)Flouranthene		54		120	480	1800	2200	2500	1000	2600	360J	1400*	950*				260	80	450	820	310	
Benzo(k)Flouranthene		54		120	480	1800	2200	1600	1000	2600	360J	1400*	480*	770	460J	820						
Benzo(a)Pyrene		140		300	420	800J	2000	990J		1200		390*		580J		490J	280	40	600	440	410	
Indeno(1,2,3-cd)Pyrene				23									250J		260J	140	30	140	230			
Dibenzo(a,h)Anthracene		110		220									250J		300J							
Benzo(g,h,i)Perylene																190	37	480	340			

Alcyon Lake Sediments

(mg/kg)

	S & A 1979 Water 1	2	3	4	Hart 1981	Radian 1982	CDM 1985 B1 Shllw	Deep	B2 Shllw	Deep	B3 Shllw	Deep	B4 Shllw	Deep	CDM 1986 SE19	SE20	SE21	EPA/ERT 1988 L5 Shllw	L5 Deep	L6	L7	L8 Shllw	L8 Deep
Arsenic	0.3	0.9	22*	0.9	1.3	4.0	19			3.5		4.7		4.1				.7B	.3B	5.2	6.1	8.7	21
Beryllium			1.3								2.3	0.4		0.7									
Cadmium			2.3	0.7	1.6	1.7						6.1		2.9						2.0	2.5	2.0B	4.2
Chromium	7.9	8.5	70	3.9	5.5	1.1	91		24	31	39	17	29	38	23	19	234	5.6	4.3	26	40	65	925
Copper	4.2	2.8	120	1.5	12	1.5	132	149	46	14*	41	16	31	24	18	18		5.5	4.8	41	55	77	434
Lead	150	57	82	14	1.3	9.6	597	360	460	48	343*	46	167*	54	57	142	149	30	21	304	385	562	451
Mercury	1.0	0.2	0.4	0.1			1.1*	0.7	1.1	0.08	0.5		0.33	0.29	0.3	0.3	0.5			0.17			
Nickel	4.5	2J	2J		5.9	6.1	50	98		10	17	14		14	9	11	123	2.9B	3.1B	20	25	33	369
Selenium			0.5			4.8									4J	4.2J	4.4J						
Silver								6.5										0.2	.3B	.4B	1.4		
Thalium																							
Vanadium						6.1	75	60	17	9	29	12	18	10	8	11	23						
Zinc	16	15	310	17	110	75	522	402	425	68	281	52	210	86	80*	98J	264J	45	33	297	316	386	546

SUMMARY OF AIR SAMPLING PROGRAMS*

COMPOUND	NJIT 1979 LEA	HART[a] 1980 LEA	NJDEP	WESTON-TAT[b] 1985				
				LEA Z-1	LEA Z-2	LEA Z-3	VENTS	LAKE
ACETONE						1.0		
BENZENE	D[c]					1.1	20	
BCEE						0.44		
C_3ALKYL BENZENE					0.1	0.2	0.1	0.1
C_6ALKANE						0.25		
C_7ALKANE						1.2		
C_8ALKANE							1.1	1.1
CHLOROFORM							D	
CHLOROETHANE							0.69	
1,1-DCA							10J	
[illegible]-DCA						0.29	30J	
1,1-DCE							10	
DICHLOROMETHANE						0.12	88	
1,4-DIOXANE						0.01		
ETHYL BENZENE						0.45	1.8	0.085
NAPTHALENE					0.12		2.0	
PHENOL				0.04	0.06			
PCE						2.5	12	
1,1,1-TCA				1.6	1.2	2.7	1.0	0.18
1,1,2-TCA						0.67		
TCE	D				0.16	D	2.0	0.16
TOLUENE	D					2.5	20	0.58
XYLENES	D					1.04	7.2	0.38
[illegible]C		40ppm						

-ALL CONCENTRATIONS ARE IN PPM-

* This summary table includes air-monitoring programs preformed prior to the TAGA program.

[a] Fred C. Hart (1980) samples were analysed for TOC alone.

[b] WESTON-TAT (1985) samples were in conjunction with the Off-site remedial investigation performed by CDM.

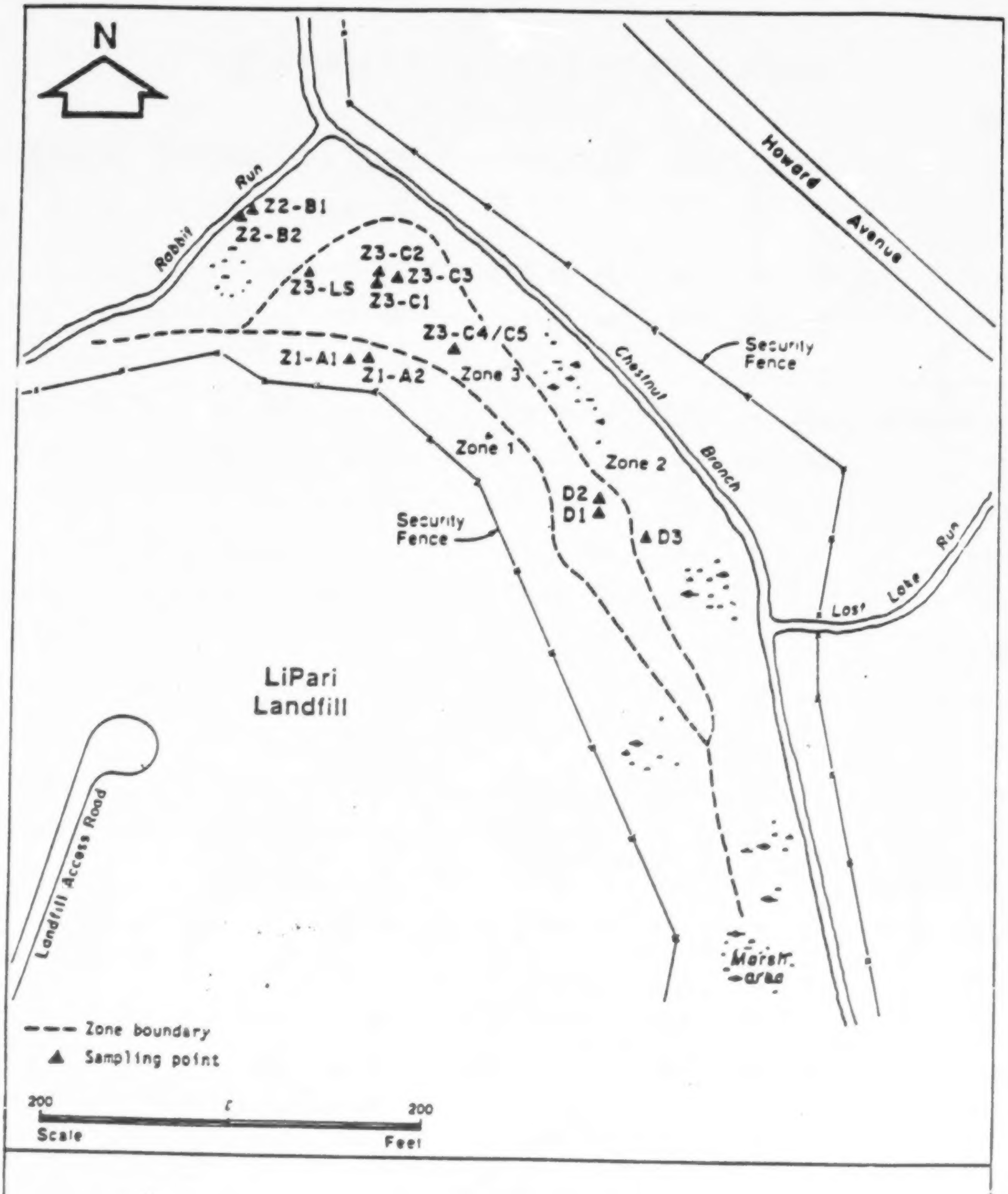
[c] "D" flag indicates that a compound was detected but not quatified.

"J" indicates an estimated concentration.

LEA indicates air samples taken above leachate seeps in the Chestnut Branch marsh.

VENT indicates air samples taken at the on-site passive gas vents

LAKE indicates air samples taken above Alcyon Lake.


N
Rabbit Run
Howard Avenue
Z2-B1
Z2-B2
Z3-C2
Z3-C3
Z3-LS
Z3-C1
Z3-C4/C5
Security Fence
Z1-A1
Z1-A2
Zone 3
Chestnut Branch
Zone 1
Zone 2
D2
D1
D3
Security Fence
Lost Lake Run
LiPari Landfill
Landfill Access Road
Marsh area
Zone boundary
Sampling point
200
0
200
Scale
Feet

Marsh Air Emission Sampling Sites and Zones

LiPari Landfill, Gloucester County, New Jersey

SUMMARY OF TAGA RESIDENTIAL AIR MONOTORING PROGRAM

LOCATION & SEASON *

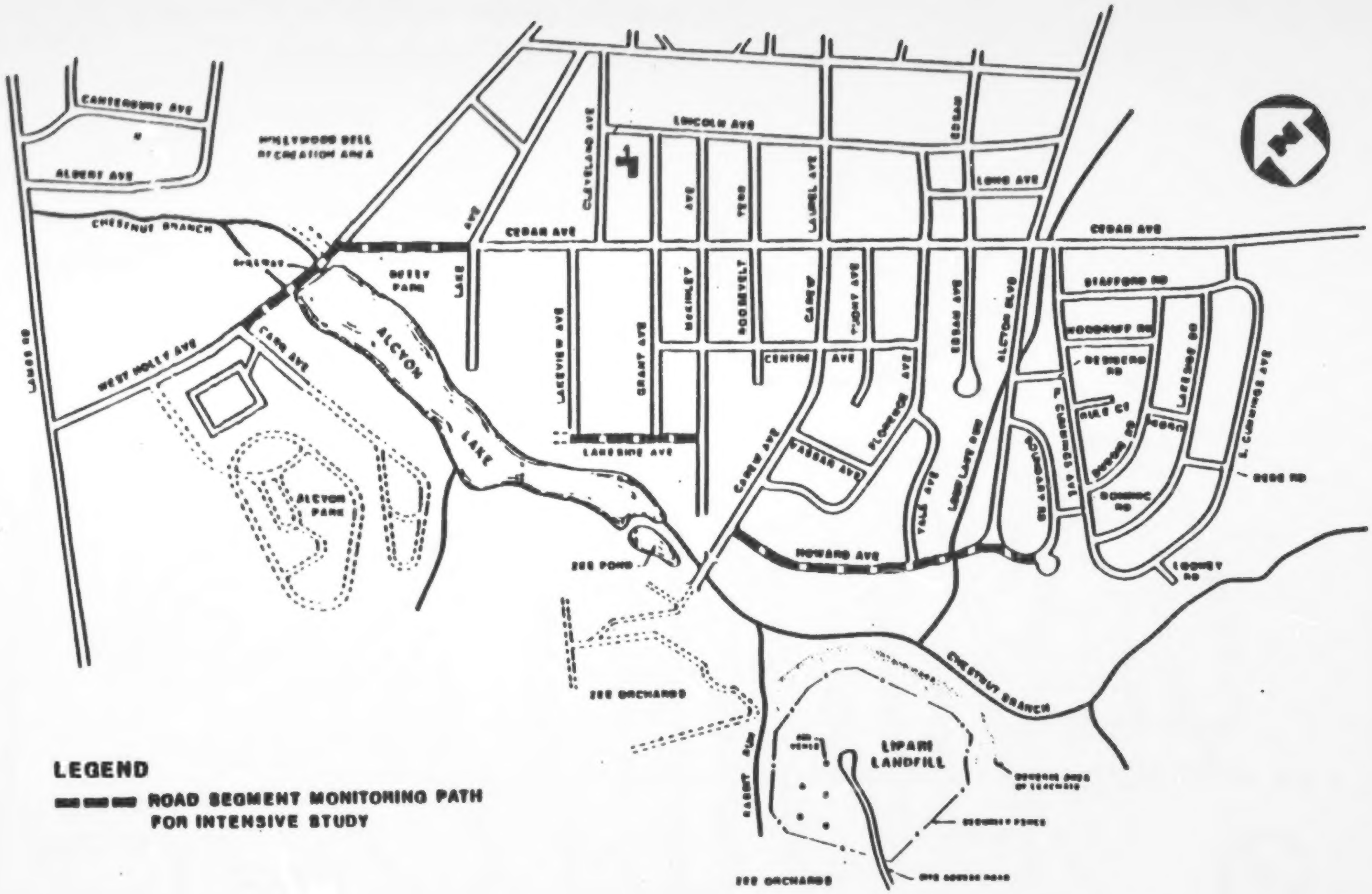
COMPOUND	HOWARD AVENUE			HOLLY/CEDAR			LAKESIDE			NEIGHBORHOODS			SPILLWAY		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ACETONE	66	43	369	165	89	53J	21J	72	81	33J	17	39J	12J	27	36J
BENZENE	5J	4J	25	20J	3J	-	-	4J	8J	-	-	8J	-	-	-
BCEE	-	3J	-	-	-	-	-	-	-	-	-	-	-	-	-
C3ALKYL BENZENES	15J	-	-	-	-	-	-	-	-	14J	-	-	-	-	-
1,1-DCA	6J	180	4J	-	3J	-	-	6J	4J	4J	4J	-	-	3J	-
1,2-DCA	-	5	10J	-	1J	-	-	-	-	-	-	-	-	1J	-
1,1-DCE	-	2J	6J	-	-	-	-	-	-	-	-	2J	-	-	-
DICHLOROMETHANE	-	37	45J	-	12J	-	-	30J	17J	-	22J	-	-	12J	-
1,4-DIOXANE	-	5J	-	-	6J	-	-	6J	-	-	-	-	-	3J	-
ETHYL BENZENE	-	9J	7J	-	13J	-	-	8J	-	23J	-	14J	-	-	-
FREON-12	-	-	14J	-	-	-	-	-	4J	-	-	-	-	-	-
ISOPROPYL BENZENE	-	10J	-	-	-	-	-	5J	-	-	-	-	-	6J	-
MIK	-	6J	-	-	8J	-	-	5J	-	-	4J	-	-	12J	-
METHYLENE CHLORIDE	-	-	-	-	-	-	-	-	-	24J	-	-	-	-	-
1,1,1-TCA	-	2J	7J	-	1J	-	-	1J	-	-	1J	18	-	-	-
1,1,2-TCA	-	9J	31J	-	-	-	-	-	-	-	-	6J	-	-	-
TCE	-	7J	39J	-	-	-	-	7J	-	-	-	-	-	-	-
TOLUENE	9J	8J	26	-	7J	-	-	18	8J	10J	-	16J	-	-	-

* SEASONS: 1-SPRING; Sampling performed during May and June, 1986.

2-SUMMER; Sampling performed during September, 1986.

3-FALL; Sampling performed during October and November, 1987.

"J" Compounds flagged with a "J" indicates that the compound was detected. A value that is between the instrument detection limit and quantitation limit will be flagged wiyh a "J", indicating an estimated value.


CANTERBURY AVE
ALBERT AVE
HOLLYWOOD BELL RECREATION AREA
CHESTNUT BRANCH
SPILLWAY
LAMBS RD
WEST HOLLY AVE
CAPE AVE
BETTY PARK
LAKE AVE
ALCYON LAKE
ALCYON PARK
CEDAR AVE
CLEVELAND AVE
LAKEVIEW AVE
GRANT AVE
LAKESIDE AVE
LINCOLN AVE
McKINLEY AVE
ROOSEVELT
TERR
LAUREL AVE
CAREW
CENTRE AVE
FLORENCE AVE
VASSAR AVE
CAREW AVE
YALE AVE
EDGAR
LONG AVE
EDGAR AVE
ALCYON BLVD
LONG LAKE DR
BOUNDARY RD
E. CUMMINGS AVE
STAFFORD RD
WOODRUFF RD
DESIDERO RD
RIALE CT
LAKESIDE DR
DOMINIC RD
E. CUMMINGS AVE
DEBE RD
ROONEY RD
HOWARD AVE
SEE POND
SEE ORCHARDS
RABBIT RUN
CHESTNUT BRANCH
LIPARI LANDFILL
SECURITY FENCE
SITE ACCESS ROAD
SEE ORCHARDS

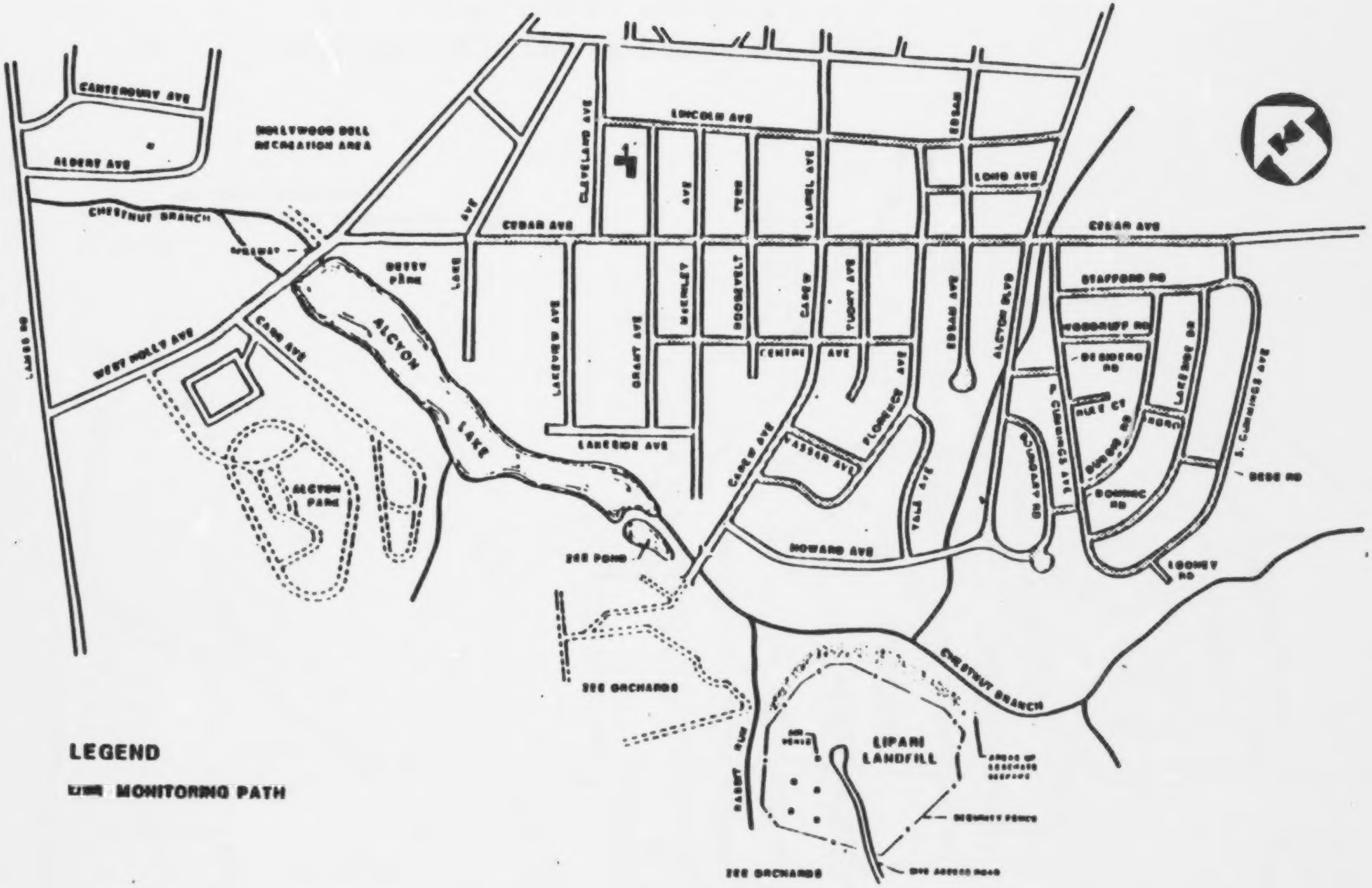
LEGEND

▬▬▬ ROAD SEGMENT MONITORING PATH FOR INTENSIVE STUDY

ROAD SEGMENTS FOR INTENSIVE MONITORING

LIPARI LANDFILL, PITMAN, N.J.

APPROX. SCALE: 1" - 900'


CANTERBURY AVE
ALBERT AVE
HOLLYWOOD BELL RECREATION AREA
CHESTNUT BRANCH
SPILLWAY
LAMBS RD
WEST HOLLY AVE
CARR AVE
ALCYON PARK
BETTY PARK
ALCYON LAKE
LAKE AVE
CEDAR AVE
CLEVELAND AVE
LINCOLN AVE
LAKEVIEW AVE
LAKESIDE AVE
GRANT AVE
McKINLEY AVE
ROOSEVELT
AVE
PENN
LAUREL AVE
CAREW
TUOHY AVE
CENTRE AVE
CAREW AVE
VASSAR AVE
FLORENCE AVE
VALE AVE
EDGAR
EDGAR AVE
LONG AVE
ALCYON BLVD
HOWARD AVE
STAFFORD RD
WOODRUFF RD
DESIDERO RD
E. CUMMINGS AVE
BOUNDARY RD
LAKESIDE DR
S. CUMMINGS AVE
BEBE RD
DOMINIC RD
LOONEY RD
SEE POND
SEE ORCHARDS
RABBIT RUN
LIPARI LANDFILL
AREAS OF LEACHATE SEEPAGE
SECURITY FENCE
SITE ACCESS ROAD
SEE ORCHARDS

LEGEND

▨ MONITORING PATH

NEIGHBORHOOD AIR MONITORING PATHS

LIPARI LANDFILL, PITMAN, N.J.

APPROX. SCALE: 1"-900'

Summary of Compounds Tentatively Identified by TAGA During Spectral
Analysis of Spring Leachate, Headspace, and Vent Samples.

	Sample Locations (1)																Sample Locations (						NJY6	NJY6	NJY6	NJY6					
Compound	Z1L1	Z1L2	Z1L3	Z1L4	Z1L5	Z2L1	Z2L2	Z2L3	Z2L4	Z2L5	Z3L1	Z3L2	Z3L3	Z4L1	Z4L2	Z4L3	Z5L1	Z5L2	Z5L3	Z6L1	Z6L2	Z6L3	SW1	SW2	SW3	SW4	V1	V2	V3	V4	V5
Di-N-propylamine	I																														
Acetone		I	I		I		I				I	I		I	I	I	I	I	I	I	I	I	I	I	I		I	I	I	I	I
Ethyl Benzene/xylenes	I	I	I	I		I	I	I	I					I	I	I	I		I	I	I										
Methyl Isobutyl Ketone	I		I				I																								
2-Methyl-1-butanol	I																														
Propylene glycol	I																														
Acrylamide	I																														
Dichloroethane	I		I																												
Bis-(2-chloroethyl) ether	I	I	I	I		I	I	I	I		I		III	I	I	I	I	I		I	I	I			I						
Acrolein		I																													
Propanols		I	I	I	I		I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I		I	I	I	I	I
Benzene		I	I			I	I	I	I								I	I	I		I										
Toluene		I	I	I	I	I	I	I	I	I	I		I	I	I	I	I	I	I	I	I	I	I	I	I	I					
C4 Alkyl Aromatics (1)		I				I									I	I															
C3 Alkyl Aromatics (2)		I	I	I		I		I	I					I	I	I	I														
2-Heptanone		I					I									I															
Benzyl alcohol				I																											
Ethylene glycol				I			I	I	I	I	I	I			I		I	I	I	I	I	I									
Diethyl ether							I																								
Carbon Tetrachloride								I			I			I					I	I		I									
C8 Hydrocarbons (3)				I				I		I	I								I												
C7 Hydrocarbons (3)									I	I	I																				
C9 Hydrocarbons (3)									I	I		I																			
C10 Hydrocarbons (3)									I																						
C5 Aldehyde or Ketone										I																					
Picoline/Phenol (4)				I	I					I				I			I		I	I	I	I	I	I		I				I	I
Butanol													I																		
C6 Hydrocarbon (3)													I	I									I								
Dimethyl Benzaldehyde (5)														I																	
C5 Nitrile (6)															I																
C7 Oxygenated hydrocarbon (7)			I												I																
Styrene (Ethylene benzene)				I													I				I										
Chlorobenzene																	I	I													

Notes:

(1) C4 Alkyl Aromatics refers to any compound with 4 carbons substituted onto a benzene ring regardless of the degree of unsaturation of the side chains. (Ex. butyl benzene)

(2) C3 Alkyl Aromatics refers to any compound with 3 carbons substituted onto a benzene ring regardless of the degree of unsaturation of the side chains. (Ex. isopropyl benzene & 2-propenyl benzene)

(3) C8 hydrocarbons refers to any non-substituted hydrocarbon with 8 carbons in its structure. Includes both alkanes and alkenes.

(4) Picoline/phenol refers an unknown which fragments similar to picoline, phenol, or methyl pyridine. The TAGA cannot easily distinguish between these compounds in dirty samples.

(5) Dimethyl benzaldehyde may be formed in the source by a excess of of xylenes and the water vapor.

(6) C5 nitrile refers to "2-Methylene-Butanenitrile or 2-Pentenenitrile". The TAGA is unable to define the exact hydrocarbon structure and degree of unsaturation of the original compound in this sample.

(7) C7 Oxygenated hydrocarbon also includes Oxygenated cycloheptane

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CONTAMINANTS TENTATIVELY IDENTIFIED BY TAGA DURING SPECTRAL ANALYSIS OF LEACHATE AND LAKE SURFACE HEADSPACE SAMPLES AND AIR VENT GRAB SAMPLES

SEPTEMBER 1986

Compound	Sample Locations (1)																							
	Z1L1	Z1L2	Z1L3	Z2L1	Z2L2	Z2L3	Z3L1	Z3L2	Z3L3	Z4L1	Z4L2	Z4L3	Z5L1	Z5L2	Z5L3	Z6L1	Z6L2	Z6L3	SW1	SW2	SW3	V2	V3	V5
Acetone	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Propanol	x			x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Bis-(2-chloroethyl) ether	x	x	x		x	x				x	x	x	x	x	x	x								
Methyl Isobutyl Ketone	x				x					x														
C5 Oxygenated Hydrocarbon				x																				
C6 Hydrocarbons	x									x														
Carbon Tetrachloride		x	x	x		x	x	x			x	x	x	x		x	x		x	x	x			
Ethylene Glycol			x		x				x	x	x	x		x	x	x								x
Benzene	x				x	x				x	x		x	x	x	x								
Toluene	x		x		x					x	x			x		x								
1,2-Dichloroethane (2)					x																			
C2 Alkyl Aromatics					x					x	x			x			x							
1,4-Dioxane						x																		
1,1,1-Trichloroethane								x				x												
Chlorobenzene													x	x		x								
C3 Alkyl Aromatics										x							x							
Picoline/Phenol										x												x	x	
Cresol										x														
1,1-Dichloroethene																x								
C7 Hydrocarbons																								x

Notes

(1) Naming system used for leachate samples: ZiLj refers to Zone i Lea j. SWi refers to surface water sample number, Vi refers to Vent Number i Air Bag

(2) 1,2 dichloroethane/vinyl chloride identical spectra on the TAGA

(3) SW4 not reported in Enviresponse report (Enviresponse 1987c)

(4) The following target contaminants were analyzed for but were not detected

1,1 Dichloroethane	Tetrachloroethene
Dichloromethane (Methylene Chloride)	1,1,2 Trichloroethane
Freon 12	Trichloroethene

FALL AIR AND LEACHATE ANALYSES FOR LIPARI LANDFILL
PITMAN, NEW JERSEY

SUMMARY OF METHOD

The Trace Atmospheric Gas Analyzer (TAGA) 6000E was used to perform headspace analyses on leachate from the perimeter of the Lipari Landfill and surface waters from Alcyon Lake. Headspace analyses were performed on leachate and surface water samples to determine the possible concentrations of target contaminants. Air vents were directly sampled as well to determine the possible concentrations of target contaminants.

OBSERVATIONS

The headspace technique used in this phase of analyses is a modified procedure compared to that utilized in previous studies. Previously-observed data showed the formation of hydrocarbon/water clusters that possibly obscured the target compounds results and complicated the ionization process. This headspace technique perhaps can be characterized as a method development procedure. Thus, a presentation of the data in a quantitative manner could lead to different interpretations by technical reviewers. Caution should be exercised when interpreting the leachate and surface water quantitative data, as no procedure was utilized to replenish the analyte in the headspace. Additionally, no systematic performance evaluation procedure has been developed for this technique.

SAMPLE LOCATIONS:		LEA-1	LEA-2	LEA-3
HNU READINGS:		0.8 ppm	14.5 ppm	9 ppm
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	5	DL=5	DL=5	DL=5
BENZENE	6	DL=6	DL=6	DL=6
ETHYL BENZENE	28	DL=28	DL=28	DL=28
TOLUENE	147	DL=147	DL=147	DL=147
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	44	DL=44	DL=44	DL=44
TRICHLOROETHENE	8	DL=8	DL=8	DL=8
1,1,1-TRICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,1-DICHLOROETHENE	3	DL=3	DL=3	DL=3
DICHLOROMETHANE	23	DL=23	DL=23	DL=23
1,4-DIOXANE	15	DL=15	DL=15	DL=15
ACETONE	203	DL=203	DL=203	DL=203
METHYL ISOBUTYL KETONE	9	DL=9	DL=9	DL=9
FREON-12	8	DL=8	DL=8	DL=8

SAMPLE LOCATIONS:		LEA-4	LEA-5	LEA-6
HNU READINGS:		40 ppm	0.5 ppm	2 ppm
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	5	185	161	DL=5
BENZENE	6	466	9	DL=6
ETHYL BENZENE	28	401	101	DL=28
TOLUENE	147	500 *	500 *	DL=147
C3 ALKYL BENZENE	30	119	DL=30	DL=30
TETRACHLOROETHENE	44	DL=44	DL=44	DL=44
TRICHLOROETHENE	8	DL=8	DL=8	DL=8
1,1,1-TRICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1,2-TRICHLOROETHANE	15	115	DL=15	DL=15
1,1-DICHLOROETHANE	7	85	DL=7	DL=7
1,2-DICHLOROETHANE	7	387	DL=7	DL=7
1,1-DICHLOROETHENE	3	24	DL=3	DL=3
DICHLOROMETHANE	23	419	DL=23	DL=23
1,4-DIOXANE	15	DL=15	DL=15	DL=15
ACETONE	203	500 *	DL=203	DL=203
METHYL ISOBUTYL KETONE	9	299	18	DL=9
FREON-12	8	51	DL=8	DL=8

SAMPLE LOCATIONS:		LEA-7	LEA-8	LEA-9
HNU READINGS:		1 ppm	4 ppm	160 ppm
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	5	DL=5	DL=5	DL=5
BENZENE	6	DL=6	DL=6	DL=6
ETHYL BENZENE	28	DL=28	DL=28	DL=28
TOLUENE	147	DL=147	DL=147	DL=147
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	44	DL=44	DL=44	DL=44
TRICHLOROETHENE	8	DL=8	DL=8	DL=8
1,1,1-TRICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,1-DICHLOROETHENE	3	DL=3	DL=3	DL=3
DICHLOROMETHANE	23	DL=23	DL=23	DL=23
1,4-DIOXANE	15	DL=15	DL=15	DL=15
ACETONE	203	DL=203	DL=203	DL=203
METHYL ISOBUTYL KETONE	9	DL=9	DL=9	DL=9
FREON-12	8	DL=8	DL=8	DL=8

SAMPLE LOCATIONS:		LEA-10	LEA-11	LEA-12
HNU READINGS:		20 ppm	2 ppm	0.1 ppm
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	6	DL=6	DL=6	DL=6
BENZENE	9	DL=9	DL=9	DL=9
ETHYL BENZENE	45	DL=45	DL=45	DL=45
TOLUENE	281	DL=281	500 *	DL=281
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	43	DL=43	DL=43	DL=43
TRICHLOROETHENE	15	DL=15	DL=15	DL=15
1,1,1-TRICHLOROETHANE	14	DL=14	DL=14	DL=14
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1-DICHLOROETHENE	4	DL=4	DL=4	DL=4
DICHLOROMETHANE	30	DL=30	DL=30	DL=30
1,4-DIOXANE	20	DL=20	DL=20	DL=20
ACETONE	260	DL=260	DL=260	DL=260
METHYL ISOBUTYL KETONE	15	DL=15	DL=15	DL=15
FREON-12	11	DL=11	DL=11	DL=11

SAMPLE LOCATIONS:		LEA-13	LEA-14	LEA-15
HNU READINGS:		0.5 ppm	1 ppm	2 ppm
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	6	DL=6	DL=6	DL=6
BENZENE	9	DL=9	DL=9	DL=9
ETHYL BENZENE	45	DL=45	DL=45	DL=45
TOLUENE	281	DL=281	DL=281	DL=281
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	43	DL=43	DL=43	DL=43
TRICHLOROETHENE	15	DL=15	DL=15	DL=15
1,1,1-TRICHLOROETHANE	14	DL=14	DL=14	DL=14
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1-DICHLOROETHENE	4	DL=4	DL=4	DL=4
DICHLOROMETHANE	30	DL=30	DL=30	DL=30
1,4-DIOXANE	20	DL=20	DL=20	DL=20
ACETONE	260	DL=260	DL=260	DL=260
METHYL ISOBUTYL KETONE	15	DL=15	DL=15	DL=15
FREON 12	11	DL=11	DL=11	DL=11

SAMPLE LOCATIONS:		LEA-16	LEA-17	LEA-18
HNU READINGS:		<0.5 ppm	<0.5 ppm	NO READING
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	6	DL=6	DL=6	DL=6
BENZENE	9	DL=9	DL=9	DL=9
ETHYL BENZENE	45	DL=45	DL=45	DL=45
TOLUENE	281	DL=281	DL=281	DL=281
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	43	DL=43	DL=43	DL=43
TRICHLOROETHENE	15	DL=15	DL=15	DL=15
1,1,1-TRICHLOROETHANE	14	DL=14	DL=14	DL=14
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	9	DL=9	DL=9	DL=9
1,1-DICHLOROETHENE	4	DL=4	DL=4	DL=4
DICHLOROMETHANE	30	DL=30	DL=30	DL=30
1,4-DIOXANE	20	DL=20	DL=20	DL=20
ACETONE	260	DL=260	DL=260	DL=260
METHYL ISOBUTYL KETONE	15	DL=15	DL=15	DL=15
FREON 12	11	DL=11	DL=11	DL=11

DL - DETECTION LIMITS
ppb - PARTS PER BILLION
OBS. CONC. - OBSERVED CONCENTRATION
* - MAXIMUM VALUES OBSERVED ABOVE 500 ppb
ppm - PARTS PER MILLION

CONCENTRATION OF TARGET CONTAMINANTS
IN AIR VENT SAMPLES

			VENT 1		VENT 2		VENT 3	
			POINT 1	POINT 2	POINT 1	POINT 2	POINT 1	POINT 2
COMPOUND	AVG. DL (ppb)	AVG. QL (ppb)	AVG. CONC. (ppb)	AVG. CONC. (ppb)	AVG. CONC. (ppb)	AVG. CONC. (ppb)	AVG. CONC. (ppb)	AVG. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	1	4	DL=1	DL=1	DL=1	DL=1	DL=1	DL=1
BENZENE	5	17	DL=5	DL=5	DL=5	DL=5	DL=5	DL=5
ETHYL BENZENE	6	20	DL=6	DL=6	DL=6	DL=6	DL=6	DL=6
TOLUENE	5	18	DL=5	DL=5	DL=5	DL=5	DL=5	DL=5
C3 ALKYL BENZENE	20	65	DL=20	DL=20	DL=20	DL=20	DL=20	DL=20
TETRACHLOROETHENE	18	60	DL=18	DL=18	DL=18	DL=18	DL=18	DL=18
TRICHLOROETHENE	4	13	DL=4	DL=4	DL=4	DL=4	DL=4	DL=4
1,1,1-TRICHLOROETHANE	2	8	DL=2	DL=2	DL=2	DL=2	DL=2	DL=2
1,1,2-TRICHLOROETHANE	4	13	DL=4	DL=4	DL=4	DL=4	DL=4	DL=4
1,1-DICHLOROETHANE	1	3	DL=1	DL=1	DL=1	DL=1	DL=1	DL=1
1,2-DICHLOROETHANE	2	6	DL=2	DL=2	DL=2	DL=2	DL=2	DL=2
1,1-DICHLOROETHENE	2	5	DL=2	DL=2	DL=2	DL=2	DL=2	DL=2
DICHLOROMETHANE	11	34	DL=11	DL=11	DL=11	DL=11	DL=11	DL=11
1,4-DIOXANE	3	10	DL=3	DL=3	DL=3	DL=3	DL=3	DL=3
ACETONE	14	47	43 J	41 J	43 J	35 J	35 J	35 J
METHYL ISOBUTYL KETONE	4	14	DL=4	DL=4	DL=4	DL=4	DL=4	DL=4
FREON-12	3	10	DL=3	DL=3	DL=3	DL=3	DL=3	DL=3

CONCENTRATIONS OF TARGET COMPOUNDS
OF SURFACE WATER SAMPLES

SAMPLE LOCATIONS:		SW-1	SW-2	SW-3	SW-4
HNU READINGS:		NO READING	NO READING	NO READING	NO READING
COMPOUND	AVG. DL (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)	OBS. CONC. (ppb)
BIS(2-CHLOROETHYL) ETHER	6	DL=6	DL=6	DL=6	DL=6
BENZENE	9	DL=9	DL=9	DL=9	DL=9
ETHYL BENZENE	45	DL=45	DL=45	DL=45	DL=45
TOLUENE	281	500 *	500 *	DL=281	500 *
C3 ALKYL BENZENE	30	DL=30	DL=30	DL=30	DL=30
TETRACHLOROETHENE	43	DL=43	DL=43	DL=43	DL=43
TRICHLOROETHENE	15	DL=15	DL=15	DL=15	DL=15
1,1,1-TRICHLOROETHANE	14	DL=14	DL=14	DL=14	DL=14
1,1,2-TRICHLOROETHANE	15	DL=15	DL=15	DL=15	DL=15
1,1-DICHLOROETHANE	7	DL=7	DL=7	DL=7	DL=7
1,2-DICHLOROETHANE	9	DL=9	DL=9	DL=9	DL=9
1,1-DICHLOROETHENE	4	DL=4	DL=4	DL=4	DL=4
DICHLOROMETHANE	30	DL=30	DL=30	DL=30	DL=30
1,4-DIOXANE	20	DL=20	DL=20	DL=20	DL=20
ACETONE	260	DL=260	DL=260	DL=260	DL=260
METHYL ISOBUTYL KETONE	15	DL=15	DL=15	DL=15	DL=15
FREON-12	11	DL=11	DL=11	DL=11	DL=11

DL - DETECTION LIMITS
ppb - PARTS PER BILLION
OBS. CONC. - OBSERVED CONCENTRATION
* - MAXIMUM VALUES OBSERVED ABOVE 500 ppm
ppm - PARTS PER MILLION

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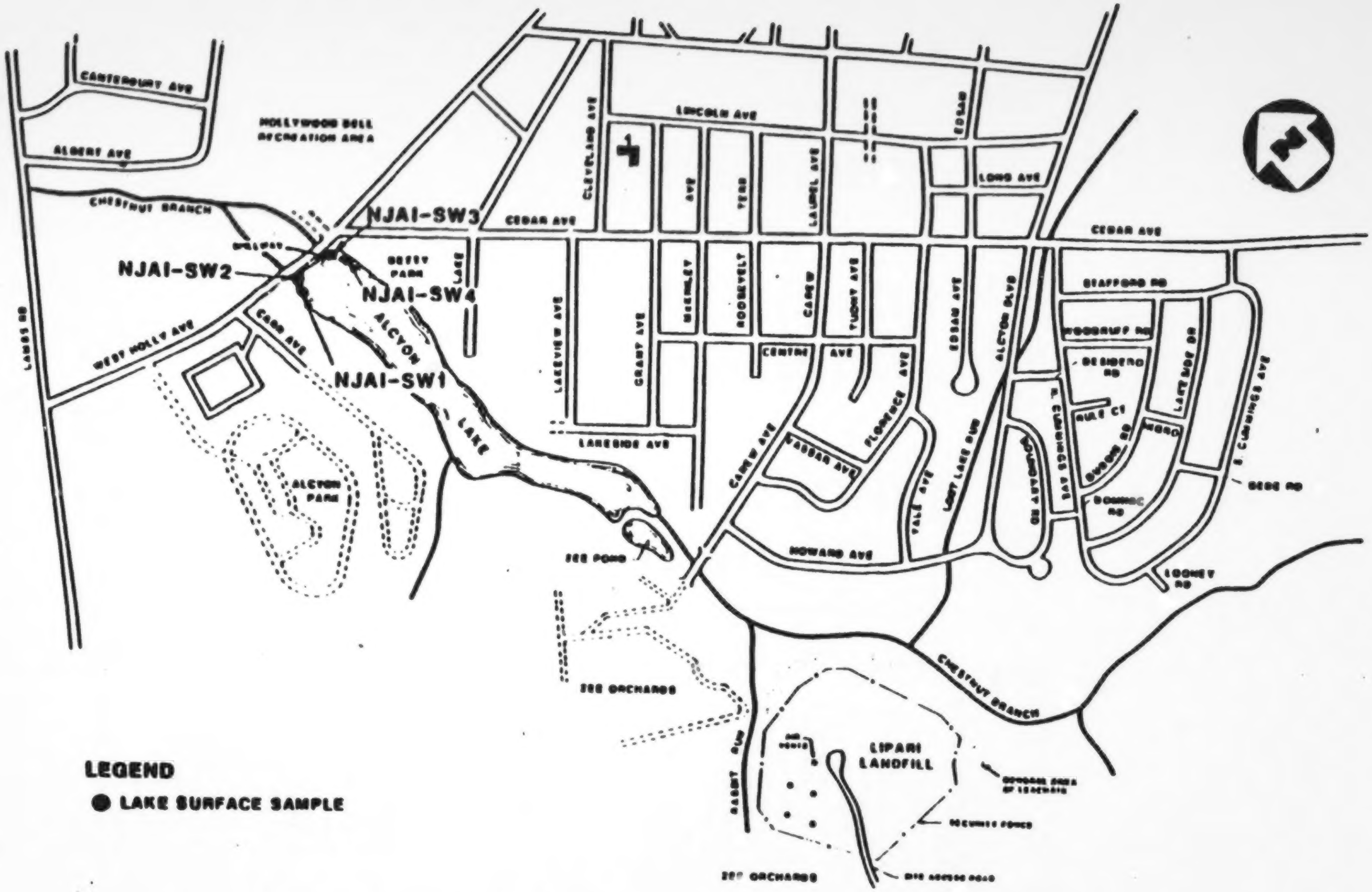
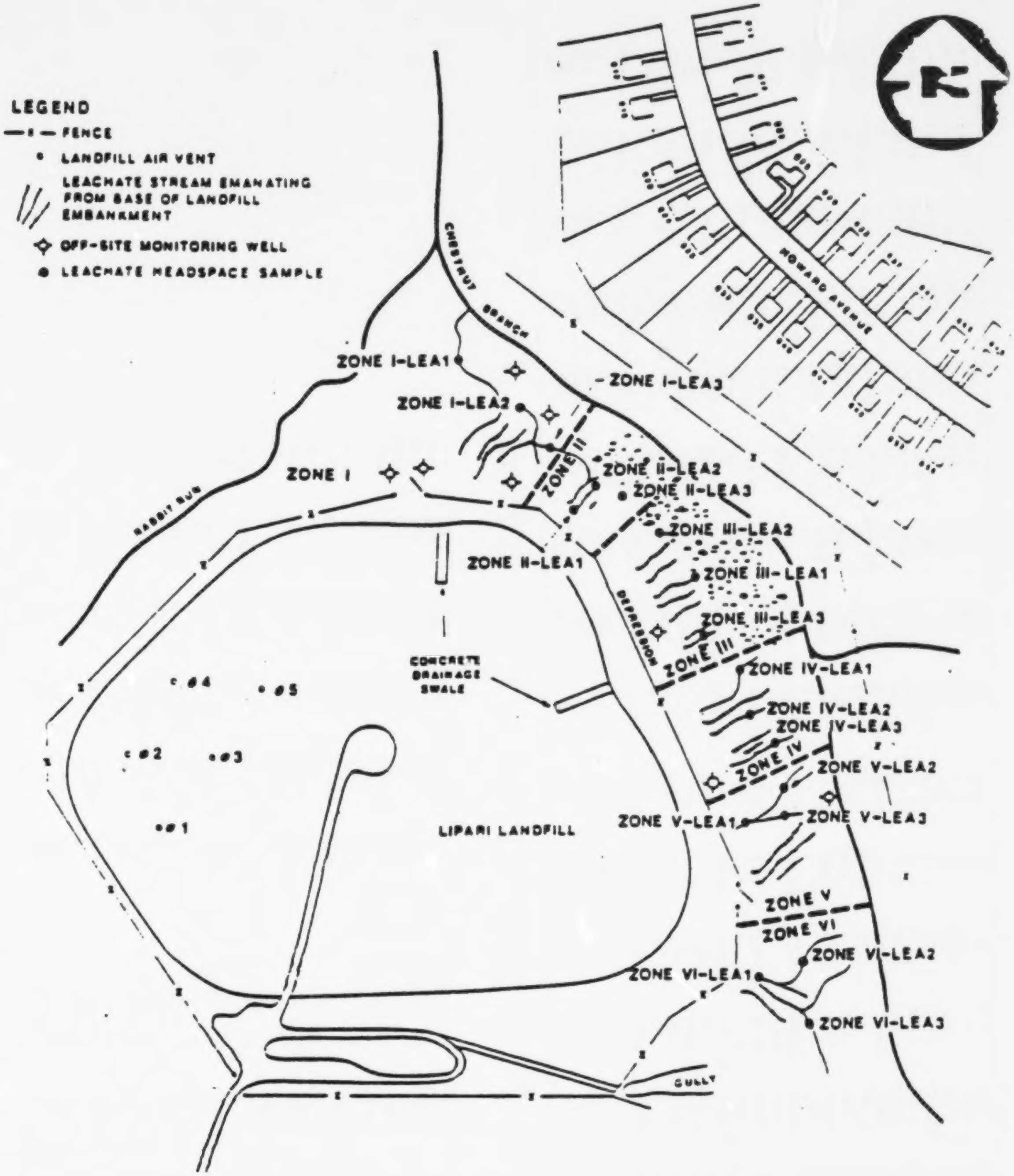

CANTERBURY AVE
ALBERT AVE
HOLLYWOOD BELL RECREATION AREA
CHESTNUT BRANCH
LAMBS RD
WEST HOLLY AVE
CARR AVE
NJAI-SW3
NJAI-SW2
NJAI-SW4
NJAI-SW1
BETTY PARK
LAKE
ALCYON
LAKE
ALCYON PARK
CEDAR AVE
CLEVELAND AVE
LAKEVIEW AVE
GRANT AVE
LAKESIDE AVE
MCKINLEY AVE
ROOSEVELT
TERR
CAREW
LAUREL AVE
TUOHY AVE
CENTRE AVE
LINCOLN AVE
EDGAR
LONG AVE
EDGAR AVE
ALCYON BLVD
LOST LAKE RUN
YALE AVE
FLORENCE AVE
FARRAR AVE
CAREW AVE
HOWARD AVE
STAFFORD RD
WOODRUFF RD
DESIDERIO RD
RULE CT
LAKE SIDE DR
E. CUMMINGS AVE
BOUNDARY RD
DOMINIC RD
LOONEY RD
BEBE RD
SEE POND
SEE ORCHARDS
RABBIT RUN
LIPARI LANDFILL
SEE ORCHARDS
SECURITY FENCE
SITE ACCESS ROAD
CHESTNUT BRANCH
LEGEND
● LAKE SURFACE SAMPLE

LAKE SURFACE HEADSPACE SAMPLE LOCATIONS AND NUMBERS

LIPARI LANDFILL, PITMAN, N.J.


LEGEND
FENCE
LANDFILL AIR VENT
LEACHATE STREAM EMANATING FROM BASE OF LANDFILL EMBANKMENT
OFF-SITE MONITORING WELL
LEACHATE HEADSPACE SAMPLE
CHESTNUT BRANCH
HOWARD AVENUE
RABBIT RUN
ZONE I-LEA1
ZONE I-LEA2
ZONE I-LEA3
ZONE I
ZONE II
ZONE II-LEA2
ZONE II-LEA3
ZONE II-LEA1
ZONE III-LEA2
ZONE III-LEA1
ZONE III-LEA3
ZONE III
DEPRESSION
CONCRETE DRAINAGE SWALE
#4
#5
#2
#3
#1
LIPARI LANDFILL
ZONE IV-LEA1
ZONE IV-LEA2
ZONE IV-LEA3
ZONE IV
ZONE V-LEA2
ZONE V-LEA1
ZONE V-LEA3
ZONE V
ZONE VI
ZONE VI-LEA2
ZONE VI-LEA1
ZONE VI-LEA3
GULLY

LEACHATE HEADSPACE AND AIR VENT GRAB SAMPLE LOCATIONS AND NUMBERS

LIPARI LANDFILL, PITMAN, N.J.

CDM 1987

Sample location	R-1	R-2	R-3A	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12	R-13	R-14	R-16
Aluminum	535	388	388	241	140U	[178]	140	525	594	596	7580	318	1260	[190]	469
Antimony	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U	57U
Arsenic	10U	10U	10U	10U	10U	10U	10U	10U	10U	10U	19	10U	10U	10U	10U
Barium	[125]	[196]	1610	450	[42]	[86]	[200]	[81]	[38]	[21]	668	[22]	[23]	[52]	[69]
Beryllium	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U
Cadmium	4.7U	4.7U	64	4.7U	4.7U	4.7U	4.7U	4.7U	24	4.7U	7.9	4.7U	4.7U	4.7U	4.7U
Calcium	50000	6000	62000	54200	9640	23200	38500	116000	88100	30700	128000	38200	54300	15200	22000
Chromium	7.8U	7.8U	10	7.8U	7.8U	7.8U	7.8U	7.8U	13	60	7.8U	7.8U	16	16	20
Cobalt	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U	20U
Copper	[20]R	14UR	14UR	14UR	14UR	14UR	14UR	14UR	14UR	[20]R	14UR	[24]R	31R	58R	14UR
Cyanide	10J	11J	*	*	*	*	*	*	*	*	*	*	*	*	*
Iron	13400	21600	184000	60500	41500	12300	74200	[59]	376	1180	169000	259	1680	324	1760
Lead	*	5UR	1040J	*	5UR	*	*	5UR	5UR	*	5UR	5UR	5UR	5UR	5UR
Magnesium	[3260]	3560	42600	14800	[1250]	2290	[2180]	470U	470U	[508]	22400	470U	470U	[2190]	[2090]
Manganese	129	165	1240	446	311	257	911	10U	10U	[12]	445	10U	[13]	62	63
Mercury	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR	0.16UR
Nickel	25U	25U	45	25U	25U	25U	25U	25U	25U	[38]	[28]	25U	25U	25U	[31]
Potassium	5180	[3100]	9360	5710	2060	8310	12500	15600	8310	[3100]	38000	[4143]	6230	[1540]	[4140]
Selenium	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR	5UR
Silver	7.1UR	*	*	*	*	*	*	*	*	7.1UR	7.1UR	7.1UR	*	*	*
Sodium	6140	13900	132000	6060	4510U	4510	[4810]	43300	27400	24200	133000	14700	3580	7060	24700
Thallium	10UR	*	*	*	*	*	*	*	*	10UR	100UR	10UR	*	*	*
Tin	36U	36U	36U	36U	36U	36U	36U	36U	36U	36U	36U	205	36U	136	42
Vanadium	21U	21U	[23]	21U	21U	21U	21U	21U	21U	[23]	[36]	21U	[28]	21U	21U
Zinc	215	128	35300	19U	19U	91	95	19U	19U	19U	220	51	19U	19U	19U

Sample location	C-29	C-29 DU
Aluminum	1038	1415
Antimony	50U	50U
Arsenic	5U	5U
Barium	[96]N	106N
Beryllium	2UN	2UN
Cadmium	6	7
Calcium	80300	79100
Chromium	27	65
Cobalt	10U	10U
Copper	10U	10U
Cyanide	10U	10U
Iron	8285	8574
Lead	*	*
Magnesium	[4600]	1000U
Manganese	194	197
Mercury	0.2U	0.2U
Nickel	30U	30U
Potassium	[3600]	[3600]
Selenium	5U	5U
Silver	61	185
Sodium	21700E	23900E
Thallium	5U	5U
Vanadium	40U	40U
Zinc	26	70

Sample location	C-31	C-32	C-33	C-33du	C-34	C-39
Aluminum	1230	3010	7630	6550	41400	2160
Antimony	57U	57U	57U	57U	57U	57U
Arsenic	10U	10U	10U	10U	10U	10U
Barium	[91]	[185]	[99]	[92]	421	[69]
Beryllium	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U
Cadmium	4.7U	4.7U	4.7U	4.7U	8.7	4.7U
Calcium	19600	20400	10600	12400	950U	22000
Chromium	7.8U	18	41	34	268	20
Cobalt	20U	20U	20U	20U	20U	20U
Copper	14UR	14UR	14UR	27	35R	14UR
Cyanide	*	*	*	*	*	*
Iron	11200	22400	28100	26000	232000	1760
Lead	*	*	*	*	231J	5UR
Magnesium	8380	13300	15800	15800	7300	[2090]
Manganese	173	346	161	162	299	63
Mercury	0.16UR	0.16UR	0.16UR	0.16UR	0.75R	0.16UR
Nickel	25U	25U	33	25U	278	[31]
Potassium	[2060]	[2060]	[2060]	[2060]	5180	[4140]
Selenium	5UR	5UR	5UR	5UR	5UR	5UR
Silver	*	*	*	*	*	*
Sodium	5450	12600	9580	7490	62100	24700
Thallium	*	*	*	*	*	*
Tin	36U	[37]	36U	[37]	36U	42
Vanadium	21U	21U	21U	21U	117	21U
Zinc	19U	19U	33	35	139	19U

J	Estimated value for a tenatively identified compound.
R	Indicates spike sample recovery was not within control limits.
U	Compound was analyzed for but not detected. Detection limit reported.
[]	The result is greater than the instrument detection limit, but less than the detection limit required by the contract.
*	Data did not pass EPA quality assurance requirements.

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Sample Location	R-1	R-2	R-3A	R-3A	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12	R-13	R-14	R-16
Volatiles:																
Acetone	770	3200	66000	NA	2000U	10U	510	150	10U	10U	800	58000	10U	10U	10U	10U
Benzene	50U	10	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	2600J	5U	5U	5U	5U
2-Butanone	79J	2000	25000	NA	2000U	10U	100U	39	10U	10U	23J	6500J	10U	10U	10U	10U
Chloroform	50U	250U	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	5000U	5U	5U	5U	5U
1,2 Dichloroethane	50U	180J	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	14000	5U	5U	5U	5U
Ethylbenzene	50U	250U	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	5000U	5U	5U	5U	5U
Methylene chloride	50U	160J	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	8800	5U	5U	5U	5U
4-Methyl-2-pentanone	100U	1300	29000	NA	2000U	10U	100U	10U	10U	10U	39J	106000	10U	10U	10U	10U
Toluene	50U	250U	25000	NA	1000U	5U	50U	5U	5U	5U	25U	5700	5U	5U	5U	5U
1,1,1-Trichloroethane	50U	250U	25000	NA	1000U	5U	50U	5U	5U	5U	25U	5000U	5U	5U	5U	5U
Total xylenes	50U	250U	2500U	NA	1000U	5U	50U	5U	5U	5U	25U	5000U	5U	5U	5U	5U
Semi-Volatiles:																
Benzoic Acid	50U	187	6200U	50U	50U	50U	50U	50U	50U	50U	50U	54000	50U	50U	50U	50U
bis(2-Chloroethyl)ether	71	3800	21000	*	10U	10U	10U	10U	10U	10U	13	55000	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	10U	260U	1260U	10U	6J	10J	10U	10U	10U	10U	10U	2000U	7J	9J	10U	10U
Isophorane	10U	260U	1260U	10U	10U	10U	10U	10U	10U	10U	10U	1500	10U	10U	10U	10U
4-Methylphenol	10U	260U	1260U	10U	10U	10U	10U	10U	10U	10U	10U	2900	10U	10U	10U	10U
Phenol	10U	410	1300	*	10U	10U	10U	10U	10U	10U	10U	28000	10U	10U	10U	10U

Sample location	C-31	C-32	C-33	C-33du	C-34	C-35
Volatiles:						
Acetone	10U	10U	10U	10U	10U	10U
Benzene	5U	5U	5U	5U	5U	5U
2-Butanone	10U	10U	10U	10U	10U	10U
Chloroform	5U	5U	5U	5U	5U	5U
1,2-Dichloroethane	5U	5U	5U	5U	5U	5U
Ethylbenzene	5U	5U	5U	5U	5U	5U
Methylene chloride	5U	5U	5U	5U	5U	5U
4-Methyl-2-pentanone	10U	10U	10U	10U	10U	10U
Toluene	5U	5U	5U	5U	5U	5U
1,1,1-Trichloroethene	5U	5U	5U	5U	5U	5U
Total xylenes	5U	5U	5U	5U	5U	5U
Semi-Volatiles:						
Benzoic Acid	50U	9J	9J	50U	50U	50U
bis(2-Chloroethyl)ether	10U	10U	10U	10U	10U	10U
bis(2-Ethylhexyl)phthalate	10U	10U	10U	10U	10U	10U
Isophorane	10U	10U	10U	10U	10U	10U
4-Methylphenol	10U	10U	10U	10U	10U	10U
Phenol	10U	10U	10U	10U	10U	10U

Key:

J	Estimated value for a tentatively identified compound.
NA	Not analyzed for.
U	Compound was analyzed for but not detected. Detection limit reported.
*	These compounds require dilution to quantify them within the linear range of the standards calibration curve.

COMPOUNDS	WELLS WITHIN CONTAINMENT SYSTEM			
SAMPLE LOC	K-2	K-2	K-3	K-3
SAMPLE #	13-1186	23	13-1187	24
CONTRACTOR	WWC	JRB	WWC	JRB
DATE SAMPLED	11-16-81	8-12-82	11-16-81	8-12-82
UNITS	PPB	PPB	PPB	PPB
VOLATILES				
ACETONE	2700	10		
BENZENE		7		30
BROMODICHLOROMETHANE				47
BROMOFORM				
CARBON DISULFIDE				
CHLOROBENZENE				
CHLOROETHANE				
CHLOROFORM				86
DICHLOROETHANE.1,1-				
DICHLOROETHANE.1.2-	250	5500		88
DICHLOROETHYLENE.TRANS-1,2-				
DICHLOROPROPANE,1,2-				
DICHLOROPROPENE,1,3-				
ETHYLBENZENE				
KETONES	30600			
METHYL4-,-2-PENTANONE				
METHYLENE CHLORIDE	140	390	60	100
STYRENE				
TETRACHLOROETHENE				
TOLUENE		4	40	51
TRICHLOROETHANE.1.1.1-				
TRICHLOROETHANE.1.1,2-				
TRICHLOROETHYLENE				
VINYL CHLORIDE				
VINYLIDENE CHLORIDE				
XYLENES(TOTAL)				
SEMIVOLATILES				
ACENAPHTHYLENE				
ANTHRACENE				
BENZO(a)PYRENE				
BIS(-2-CHLOROETHOXY)ETHANE	6100	8500	1430	8500
BIS(-2-CHLOROETHOXY)METHANE				
BIS(-2-CHLOROETHYL)ETHER	3400	7400	640	4400
BIS(2-ETHYLHEXYL)PHTHALATE				
BUTYLBENZYLPHTHALATE				
CUMENE				
DI-N-BUTYLPHTHALATE				
DI-N-OCTYL PHTHALATE				
DICHLOROBENZENE,1.2-				
DICHLOROBENZENE,1,4-				
DIETHYLPHTHALATE				
FLUORANTHENE				
FLUORENE				
METHYLPHENOL,4-				
NAPTHALENE				
PHENANTHRENE				
PHENOL		350		57
PYRENE				
TRICHLOROPHENOL.2.4.6-				

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WELLS WITHIN CONTAINMENT SYSTEM

COMPOUNDS	C-15	C-17	C-3	C-19	C-10A	C-10A	C-6A	C-6A	C-23
SAMPLE LOC	C-15	C-17	C-3	C-19	C-10A	C-10A	C-6A	C-6A	C-23
SAMPLE #	7	5		2		35		39	16
CONTRACTOR	JRB	JRB	WWC	JRB	WWC	JRB	WWC	JRB	JRB
DATE SAMPLED	8-10-83	8-10-83	6-16-81	8-10-83	6-16-81	8-12-83	6-16-81	8-12-83	8-16-83
UNITS	PPB	PPB	PPB	PPB	PPB	PPB	PPB	PPB	PPB
VOLATILES									
ACETONE									
BENZENE		790	2290	4400		78	13000	4200	1500
BROMODICHLOROMETHANE				280					
BROMOFORM									
CARBON DISULFIDE									
CHLOROBENZENE				73				270	20
CHLOROETHANE		24		47					4
CHLOROFORM		610		760				21	
DICHLOROETHANE.1,1-			230	650			200	77	40
DICHLOROETHANE,1,2-		480	30200		50	74	33800	5500	2000
DICHLOROETHYLENE,TRANS-1,2-				43			60	45	79
DICHLOROPROPANE,1,2-									
DICHLOROPROPENE,1,3-									7
ETHYLBENZENE		630	810	4400		69	5720	2600	850
KETONES									
METHYL4-,-2-PENTANONE									
METHYLENE CHLORIDE		1400	32400	39000	60	36	14600	950	450
STYRENE									
TETRACHLOROETHENE							190		30
TOLUENE	2	3200		73000		18	67900	42000	8500
TRICHLOROETHANE,1,1,1-				73					
HLOROETHANE,1,1,2-									
HLOROETHYLENE									14
VINYL CHLORIDE				76					
VINYLIDENE CHLORIDE									2
XYLENES(TOTAL)			4600				21830		
SEMIVOLATILES									
ACENAPHTHYLENE									
ANTHRACENE									
BENZO(A)PYRENE									
BIS(-2-CHLOROETHOXY)ETHANE		62000	42600	100000	37700	11000	27600	7600	5100
BIS(-2-CHLOROETHOXY)METHANE									
BIS(-2-CHLOROETHYL)ETHER		75000	34000	83000	18300	5700	14100	6500	3500
BIS(2-ETHYLHEXYL)PHTHALATE									
BUTYLBENZYLPHTHALATE									
CUMENE							300		
DI-N-BUTYLPHTHALATE									
DI-N-OCTYL PHTHALATE									
DICHLOROBENZENE,1,2-				370					
DICHLOROBENZENE,1,4-									100
DIETHYLPHTHALATE		85		350				54	17
FLUORANTHENE									
FLUORENE									
METHYLPHENOL,4-									
NAPTHALENE	10			140					47
PHENANTHRENE									
OL		12000	13900	12000			5800	4500	1700
ENE									
TRICHLOROPHENOL,2,4,6-									

COMPOUNDS		DOWNGRADIENT WELLS							
	SAMPLE LOC	C-18	C-18	CP-1	CP-8	C-27	C-27\SOIL	C-29	C-31
	SAMPLE #	1		34	BE531	BE541	BA913	-BE528	BE529
	CONTRACTOR	JRB	JRB	JRB	CDM	CDM	CDM	CDM	CDM
	DATE SAMPLED	8-10-83	12-10-84	8-12-83	5-23-85	5-29-85	5-20-85	5-22-85	5-23-85
	UNITS	PPB	PPB	PPB	PPB	PPB	PPB	PPB	PPB
VOLATILES									
ACETONE									
BENZENE		2200	1600	2400				100J	
BROMODICHLOROMETHANE		300		94					
BROMOFORM									2J
CARBON DISULFIDE									
CHLOROBENZENE		45		78					
CHLOROETHANE									
CHLOROFORM		720		190	66J				
DICHLOROETHANE,1,1-		760		180	99J				
DICHLOROETHANE,1,2-		4500		2000	8500	38			
DICHLOROETHYLENE,TRANS-1,2-		300		45					
DICHLOROPROPANE,1,2-		24							
DICHLOROPROPENE,1,3-									
ETHYLBENZENE		2400		1700					2J
KETONES									
METHYL4-,-2-PENTANONE					8300			8800	6J
METHYLENE CHLORIDE		5000		350					
STYRENE									2J
TETRACHLOROETHENE									2J
TOLUENE		35000	26000	36000	130J				
TRICHLOROETHANE,1,1,1-									
TRICHLOROETHANE,1,1,2-									3J
TRICHLOROETHYLENE				21					
VINYL CHLORIDE		96							
VINYLIDENE CHLORIDE									
XYLENES(TOTAL)									
SEMIVOLATILES									
ACENAPHTHYLENE									
ANTHRACENE									
BENZO(a)PYRENE									
BIS(-2-CHLOROETHOXY)ETHANE		140000	5700	58000					
BIS(-2-CHLOROETHOXY)METHANE									
BIS(-2-CHLOROETHYL)ETHER		58000	8900	27000	8J				
BIS(2-ETHYLHEXYL)PHTHALATE				65		210J			
BUTYLBENZYLPHTHALATE							240J		
CUMENE									
DI-N-BUTYLPHTHALATE		44							
DI-N-OCTYL PHTHALATE							220J		
DICHLOROBENZENE,1,2-		64							
DICHLOROBENZENE,1,4-									
DIETHYLPHTHALATE		210		71					
FLUORANTHENE									
FLUORENE									
METHYLPHENOL,4-									
NAPTHALENE		210							
PHENANTHRENE									
PHENOL		5300		2000					
PYRENE									
TRICHLOROPHENOL,2,4,6-									

COMPOUNDS		DOWNGRADIENT WELLS					
	SAMPLE LOC	CP-2	CP-2	CP-7	C-4A	C-22	C-22
	SAMPLE #	33		88572		18	
	CONTRACTOR	JRB	JRB	CDM	WWC	JRB	JRB
	DATE SAMPLED	8-12-83	12-10-84	5-31-85	6-16-81	8-10-83	12-10-84
	UNITS	PPB	PPB	PPB	PPB	PPB	PPB
VOLATILES							
ACETONE							
BENZENE		2400	2800		3770	1100	250
BROMODICHLOROMETHANE							
BROMOFORM							
CARBON DISULFIDE							
CHLOROBENZENE		21					
CHLOROETHANE							
CHLOROFORM		164				72	
DICHLOROETHANE,1,1-		78			780	62	
DICHLOROETHANE,1,2-			5500		11500	65	
DICHLOROETHYLENE,TRANS-1,2-					200	200	
DICHLOROPROPANE,1,2-							
DICHLOROPROPENE,1,3-							
ETHYLBENZENE		1100			1770	2200	
KETONES							
METHYL-4-,-2-PENTANONE							
METHYLENE CHLORIDE		12000	14000		11300		
STYRENE							
TETRACHLOROETHENE							
TOLUENE		75000			47800	19000	1100
TRICHLOROETHANE,1,1,1-							
TRICHLOROETHANE,1,1,2-							
TRICHLOROETHYLENE							
VINYL CHLORIDE							
VINYLIDENE CHLORIDE							
XYLENES(TOTAL)					7260		
SEMIVOLATILES							
ACENAPHTHYLENE							
ANTHRACENE							
BENZO(a)PYRENE							
BIS(-2-CHLOROETHOXY)ETHANE		140000	61000		152000	47000	4100
BIS(-2-CHLOROETHOXY)METHANE							
BIS(-2-CHLOROETHYL)ETHER		75000	240000	290	88700	26000	7700
BIS(2-ETHYLHEXYL)PHTHALATE		14					
BUTYLBENZYLPHTHALATE							
CUMENE							
DI-N-BUTYLPHTHALATE				2J			
DI-N-OCTYL PHTHALATE							
DICHLOROBENZENE,1,2-		27		8J		72	
DICHLOROBENZENE,1,4-							
DIETHYLPHTHALATE		30		2J		41	
FLUORANTHENE							
FLUORENE							
METHYLPHENOL,4-							
NAPTHALENE						34	
PHENANTHRENE							
PHENOL		22000	21000		10100	38	
PYRENE							
TRICHLOROPHENOL,2,4,6-				6J			

		DOWNGRADIENT WELLS						
	SAMPLE LOC	C-11	C-11	C-24	CP-3	CP-3	C-7	C-7
	SAMPLE #		36	15	32			37
	CONTRACTOR	WWC	JRB	JRB	JRB	JRB	WWC	JRB
	DATE SAMPLED	6-16-81	8-12-83	8-12-83	8-12-83	12-10-84	6-16-81	8-12-83
COMPOUNDS	UNITS	PPB	PPB	PPB	PPB	PPB	PPB	PPB
VOLATILES								
ACETONE								
BENZENE		280	460	350	1700	6900	690	5900
BROMODICHLOROMETHANE					97			
BROMOFORM								
CARBON DISULFIDE								
CHLOROBENZENE								
CHLOROETHANE								
CHLOROFORM				43	240			200
DICHLOROETHANE,1,1-		2090		70	120		400	150
DICHLOROETHANE,1,2-				32	300	58	7350	2200
DICHLOROETHYLENE,TRANS-1,2-				58	230		120	85
DICHLOROPROPANE,1,2-								
DICHLOROPROPENE,1,3-								
ETHYLBENZENE			450	1400	660		1180	1700
KETONES								
METHYL4-,-2-PENTANONE								
METHYLENE CHLORIDE				140	93	900	4470	1100
STYRENE								
TETRACHLOROETHENE								
TOLUENE		370	630	400	6200	850	33700	48000
TRICHLOROETHANE,1,1,1-								
TRICHLOROETHANE,1,1,2-								
TRICHLOROETHYLENE								
VINYL CHLORIDE								
VINYLIDENE CHLORIDE								
XYLENES(TOTAL)		110					4200	
SEMIVOLATILES								
ACENAPHTHYLENE								
ANTHRACENE								
BENZO(a)PYRENE								
BIS(-2-CHLOROETHOXY)ETHANE			38000	13000	16000	2700	54500	37000
BIS(-2-CHLOROETHOXY)METHANE								
BIS(-2-CHLOROETHYL)ETHER			4900	13000	9000	6900	23000	20000
BIS(2-ETHYLHEXYL)PHTHALATE								
BUTYLBENZYLPHTHALATE								
CUMENE								
DI-N-BUTYLPHTHALATE								
DI-N-OCTYL PHTHALATE								
DICHLOROBENZENE,1,2-					4			
DICHLOROBENZENE,1,4-				190				
DIETHYLPHTHALATE				62	14			27
FLUORANTHENE								
FLUORENE								
METHYLPHENOL,4-								
NAPTHALENE				89	8			
PHENANTHRENE								
PHENOL			62		260	790	13400	7500
PYRENE								
TRICHLOROPHENOL,2,4,6-								

	LIPARI LANDFILL																			
	WELLS WITHIN CONTAINMENT SYSTEM												DOWNGRADIENT WELLS							
SAMPLING LOCATION	C-6A		C-23		K-2		K-2		K-3		K-3		CP-5		C-11		C-11		C-24	
SAMPLE NUMBER	39		16		NONE		23		NONE		24		MB0705		NONE		36		15	
CONTRACTOR	JRB		JRB		WAC		JRB		WAC		JRB		CDM		WAC		JRB		JRB	
DATE SAMPLED	8-12-83		8-10-83		11-16-81		8-12-83		11-16-81		8-12-83		5-23-85		6-16-81		8-12-83		8-12-83	
UNITS	mg/l		mg/l				mg/l				mg/l		mg/l				mg/l		mg/l	
COMPOUNDS	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note
METALS																				
ALUMINUM		N.A.		N.A.		N		N.A.		N		N.A.	*			N		N.A.		N.A.
ANTIMONY	(0.20	ND	(0.20			O	(0.20			O	(0.20		31	U		O	(0.20		(0.20	
ARSENIC	(0.01		(0.01				(0.01	ND			(0.01		3	U,R			0.023		(0.01	ND
BARIUM		N.A.		N.A.		M		N.A.		M		N.A.	[71]			M		N.A.		N.A.
BERYLLIUM	(0.05	ND	(0.05			E	(0.05			E	(0.05		0.3	U		E	(0.05		(0.05	ND
CADMIUM	0.015		(0.01			T	(0.01			T	(0.01		4	U		T	0.023		(0.01	
CALCIUM		N.A.		N.A.		A		N.A.		A		N.A.	7870			A		N.A.		N.A.
CHROMIUM	2.3		0.38			L	0.47			L	0.55		14	R		L	5.1		0.38	
COBALT		N.A.		N.A.		S		N.A.		S		N.A.	4	U		S		N.A.		N.A.
COPPER	0.025		(0.02				(0.02				(0.02		*				0.15		(0.02	
IRON		N.A.		N.A.		A		N.A.		A		N.A.	*			A		N.A.		N.A.
LEAD	0.031		(0.02			N	0.036			N	0.075		*			N	0.12		(0.02	
MAGNESIUM		N.A.		N.A.		A		N.A.		A		N.A.	[4390]			A		N.A.		N.A.
MANGANESE		N.A.		N.A.		L		N.A.		L		N.A.	71			L		N.A.		N.A.
MERCURY	(0.001		(0.001			Y	(0.001	ND		Y	(0.001	ND	*			Y	(0.001		0.0010	
NICKEL	0.17		0.079			S	(0.05			S	0.12		[10]			S	0.30		0.052	
POTASSIUM		N.A.		N.A.		I		N.A.		I		N.A.	[1130]			I		N.A.		N.A.
SELENIUM	0.11		0.014			S	(0.01	ND		S	0.026		*			S	0.005		(0.01	
SILVER	0.026		(0.01				0.031				0.010		3	U			0.019		(0.01	
SODIUM		N.A.		N.A.				N.A.				N.A.	*					N.A.		N.A.
THALLIUM	(0.10		(0.10				0.10				0.12		4	U			(0.10		(0.10	
TIN		N.A.		N.A.				N.A.				N.A.	17	U,R				N.A.		N.A.
VANADIUM		N.A.		N.A.				N.A.				N.A.	[5]					N.A.		N.A.
ZINC	0.25		0.029				0.034				2.1		*				0.98		0.031	
CYANIDE	(0.01		(0.01				(0.01				(0.01		*				(0.01		(0.01	
PHENOLS	0.06		3.00				1.05				0.46			N.A.			0.25		0.37	
PERCENT SOLIDS		N.A.		N.A.				N.A.				N.A.		N.A.				N.A.		N.A.

	LIPARI LANDFILL																			
	UPGRADIENT WELLS						WELLS WITHIN CONTAINMENT SYSTEM													
SAMPLING LOCATION	C-8A		K-5		C-26		C-15		C-17		C-3		C-19		C-10A		C-10A		C-6A	
SAMPLE NUMBER	27		8		12		7		NONE		NONE		NONE		NONE		35		NONE	
CONTRACTOR	JRB		JRB		JRB		JRB		JRB		WAC		JRB		WAC		JRB		WAC	
DATE SAMPLED	8-12-83		8-10-83		8-10-83		8-10-83		8-10-83		6-16-81		8-10-83		6-16-81		8-12-83		6-16-81	
UNITS	mg/l		mg/l		mg/l		mg/l										mg/l			
COMPOUNDS	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note	Q	Ft.Note
METALS																				
ALUMINUM		N.A.		N.A.		N.A.		N.A.		N		N		N		N		N.A.		N
ANTIMONY	(0.02		(0.20	ND	(0.20	ND	(0.20	ND		O		O		O		O	(0.20	ND		O
ARSENIC	0.016		(0.01	ND	(0.01	ND	(0.01										0.025			
BARIUM		N.A.		N.A.		N.A.		N.A.		M		M		M		M		N.A.		M
BERYLLIUM	(0.05		(0.05		(0.05		(0.05	ND		E		E		E		E	(0.05			E
CADMIUM	(0.01		(0.01	ND	(0.01		(0.01			T		T		T		T	0.016			T
CALCIUM		N.A.		N.A.		N.A.		N.A.		A		A		A		A		N.A.		A
CHROMIUM	1.6		0.055		0.37		0.21			L		L		L		L	5.1			L
COBALT		N.A.		N.A.		N.A.		N.A.		S		S		S		S		N.A.		S
COPPER	0.047		(0.02		(0.02		(0.02										0.050			
IRON		N.A.		N.A.		N.A.		N.A.		A		A		A		A		N.A.		A
LEAD	0.071		(0.02		(0.02		(0.02			N		N		N		N	0.032			N
MAGNESIUM		N.A.		N.A.		N.A.		N.A.		A		A		A		A		N.A.		A
MANGANESE		N.A.		N.A.		N.A.		N.A.		L		L		L		L		N.A.		L
MERCURY	(0.001		(0.001		0.0010		(0.001			Y		Y		Y		Y	0.0011			Y
NICKEL	(0.05		(0.05		0.066		0.12			S		S		S		S	0.18			S
POTASSIUM		N.A.		N.A.		N.A.		N.A.		I		I		I		I		N.A.		I
SELENIUM	(0.01	ND	(0.01		(0.01	ND		ND		S		S		S		S	0.039			S
SILVER	(0.01		(0.01		(0.01		(0.01										0.015			
SODIUM		N.A.		N.A.		N.A.		N.A.										N.A.		
THALLIUM	0.27		(0.01	ND	(0.10		(0.01	ND									(0.10			
TIN		N.A.		N.A.		N.A.		N.A.										N.A.		
VANADIUM		N.A.		N.A.		N.A.		N.A.										N.A.		
ZINC	0.19		0.026		0.025		0.046										1.2			
CYANIDE	(0.21	ND	(0.01	ND	(0.01		(0.01	ND									(0.01			
PHENOLS	0.20		0.17		0.18		1.3										0.25			
PERCENT SOLIDS		N.A.		N.A.		N.A.		N.A.										N.A.		

LIPARI LANDFILL																				
	DOWNGRADIENT WELLS																			
SAMPLING LOCATION	CP-3		CP-3		C-7		C-7		CP-2		CP-2		CP-7		C-4A		C-22		C-22	
SAMPLE NUMBER	32		NONE		NONE		37		33		NONE		H00779		NONE		18		NONE	
CONTRACTOR	JRB		JRB		WAC		JRB		JRB		JRB		CDM		WAC		JRB		JRB	
DATE SAMPLED *	8-12-83		12-10-84		6-16-81		8-12-83		8-12-83		12-10-84		5-31-85		6-16-81		8-10-83		12-10-84	
UNITS	mg/l						mg/l		mg/l				ug/l				mg/l			
COMPOUNDS	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note	Q	Fl.Note
METALS																				
ALUMINUM		N.A.		N		N		N.A.		N.A.		N	*			N		N.A.		N
ANTIMONY	< 0.20	ND		O		O	< 0.20		< 0.20			O	31	U		O	< 0.20			O
ARSENIC	0.030						0.015		< 0.01				17				< 0.01			
BARIUM		N.A.		M		M		N.A.		N.A.		M	379			M		N.A.		M
BERYLLIUM	< 0.05			E		E	< 0.05	ND	< 0.05			E	(0.4)			E	< 0.05	ND		E
CADMIUM	0.016			T		T	0.017		0.031			T	(4.3)			T	< 0.01			T
CALCIUM		N.A.		A		A		N.A.		N.A.		A	24000			A		N.A.		A
CHROMIUM	3.2			L		L	3.6		17.5			L	477			L	0.74			L
COBALT		N.A.		S		S		N.A.		N.A.		S	(14)			S		N.A.		S
COPPER	0.043						0.10		0.058				*				0.020			
IRON		N.A.		A		A		N.A.		N.A.		A	*			A		N.A.		A
LEAD	0.040			N		N	0.030		0.077			N	1140			N	0.032			N
MAGNESIUM		N.A.		A		A		N.A.		N.A.		A	6700			A		N.A.		A
MANGANESE		N.A.		L		L		N.A.		N.A.		L	*			L		N.A.		L
MERCURY	0.0016			Y		Y	<0.001	ND	<0.001	ND		Y	*			Y	<0.001	ND		Y
NICKEL	0.092			S		S	0.18		0.19			S	394			S	0.10			S
POTASSIUM		N.A.		I		I		N.A.		N.A.		I	(4420)			I		N.A.		I
SELENIUM	< 0.01	ND		S		S	0.19		0.076			S	*			S	< 0.01			S
SILVER	0.018						0.017		0.020				*				< 0.01			
SODIUM		N.A.						N.A.		N.A.			*					N.A.		
THALLIUM	< 0.10						< 0.10		< 0.10				3	U			< 0.10			
TIN		N.A.						N.A.		N.A.			17	U,R				N.A.		
VANADIUM		N.A.						N.A.		N.A.			(14)					N.A.		
ZINC	0.25						0.25		0.33				*				0.13			
CYANIDE	<0.01						< 0.01		< 0.01				*				< 0.01			
PHENOLS	0.00						0.87		6.6					N.A.			0.79			
SUSPENDED SOLIDS		N.A.						N.A.		N.A.				N.A.				N.A.		

	LIPARI LANDFILL															
	DOWNGRADIENT WELLS															
SAMPLING LOCATION	C-18		C-18		CP-1		CP-8		C-27		C-27		C-29		C-31	
SAMPLE NUMBER	NONE		NONE		34		MB0778		MB0775		NONE		MB0800		MB0773	
CONTRACTOR	JRB		JRB		JRB		CDM		CDM		CDM		CDM		CDM	
DATE SAMPLED	8-10-83		12-10-84		8-10-83		5-23-85		5-29-85		5-20-85		5-22-85		5-23-85	
UNITS					mg/l		ug/l		ug/l				ug/l		ug/l	
COMPOUNDS	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note	Q	Fl. Note
METALS																
ALUMINUM		N		N		N.A.	*		*			N	*		*	
ANTIMONY		O		O	(0.20		(33)		31	U		O	31	U	31	U
ARSENIC					0.087		43	R	(6.9)				3	U,R	3	U,R
BARIUM		M		M		N.A.	1060		*			M	(92)		(78)	
BERYLLIUM		E		E	(0.05		10		5.3			E	(0.3)		0.3	U
CADMIUM		T		T	0.068		9.2		4	U		T	4	U	4	U
CALCIUM		A		A		N.A.	65800		129000			A	93700		131700	
CHROMIUM		L		L	31.0		106	R	106			L	106	R	(9.4)	R
COBALT		S		S		N.A.	(9.5)		4	U		S	4	U	4	U
COPPER					0.20		*		*				*		*	
IRON		A		A		N.A.	*		*			A	*		*	
LEAD		N		N	0.92		*		*			N	*		*	
MAGNESIUM		A		A		N.A.	17800		(3640)			A	(4200)		8360	
MANGANESE		L		L		N.A.	568		*			L	44		135	
MERCURY		Y		Y	0.0024		*		*			Y	*		*	
NICKEL		S		S	0.70		103		6			S	77		(8.9)	
POTASSIUM		I		I		N.A.	5920		(4760)			I	(4640)		(2790)	
SELENIUM		S		S	0.029		*		*			S	*		*	
SILVER					0.080		(7.8)		*				3	U	3	U
SODIUM						N.A.	103000		*				30300		9510	
THALLIUM					0.24		10	U	3	U			10	U	4	U
TIN						N.A.	17	U,R	17	U,R			17	U,R	17	U,R
VANADIUM						N.A.	(10)		72				4	U	4	U
ZINC					1.3		91		*				*		*	
CYANIDE					(0.01		*		*				*		*	
PHENOLS					7.1			N.A.		N.A.				N.A.		N.A.
SUSPENDED SOLIDS						N.A.		N.A.		N.A.				N.A.		N.A.

FOOTNOTES

JRB DATA

N.A.	Not Analyzed
ND	Not Detected

EPA S&A DATA

N.A.	Not Analyzed
ND	Not Detected
A	Approximate Value

WWC DATA

N.A.	Not Analyzed

CDM DATA

N.A.	Not Analyzed
U	Element was analyzed for but not detected. Reported with the detection limit value (e.g. 10U).
R	Spike sample recovery is not within control limits.
[ ]	Result is greater than or equal to instrument detection limit but less than the contract required detection limit.
*	Data did not pass EPA quality assurance.
(*)	Duplicate analysis is not within control limits.

REFERENCES

Environmental Protection Agency Surveillance and Analysis (EPA S&A), 8/79.

Scientific Applications International Corporation (formerly JRB Associates, Inc.) (JRB), Long Term Remedial Action Monitoring Program, LiPari Waste Disposal Site, Priority Pollutant Sampling - 8/83.

Woodward-Clyde Consultants, Inc. (WWC), Project Summary for 1981, Groundwater Chemistry and Monitoring Well Installation (March 1981), LiPari Waste Disposal Site.

Camp Dresser & McKee Inc. (CDM), Remedial Investigation Data, 2/85-7/85.

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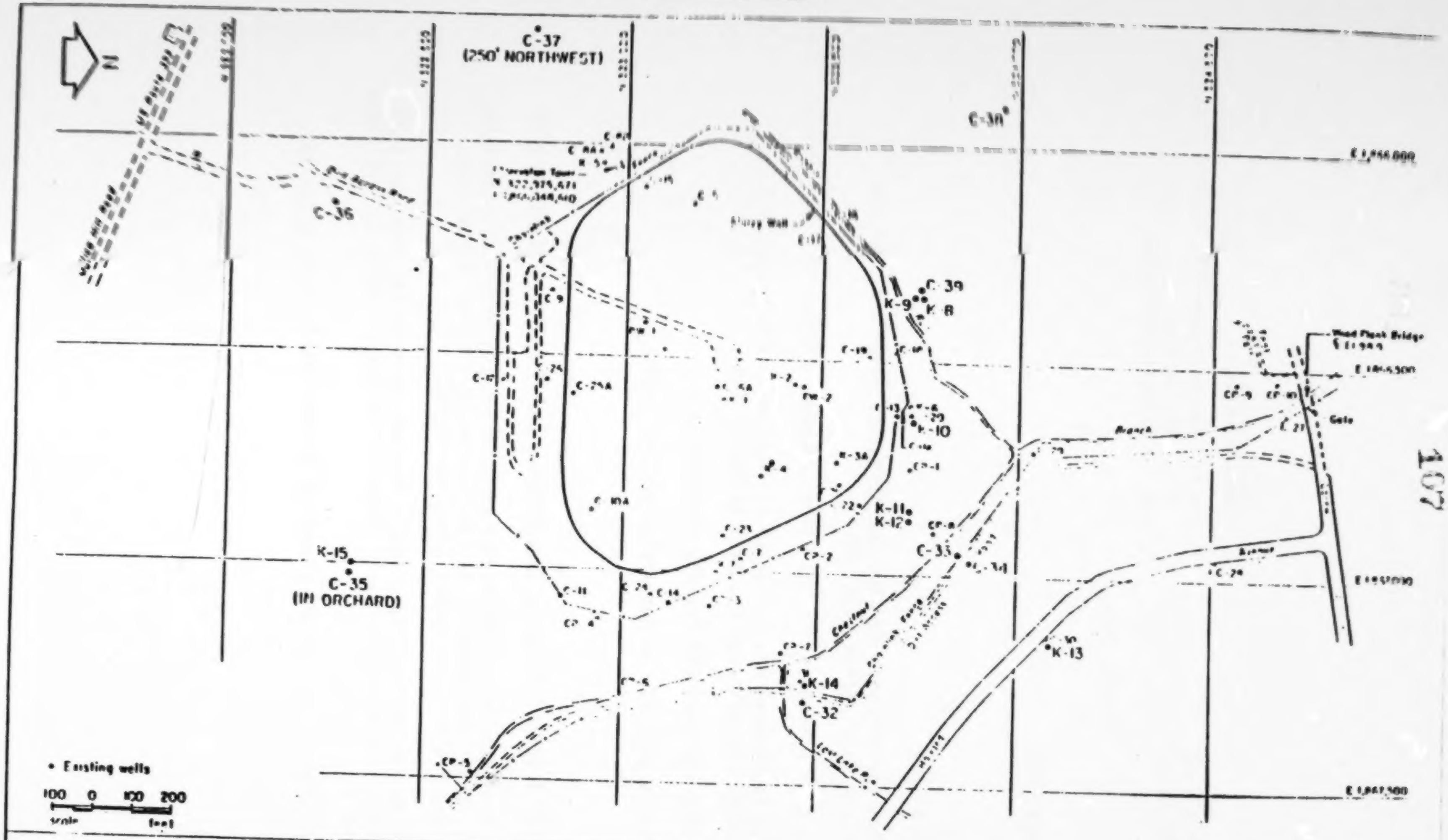
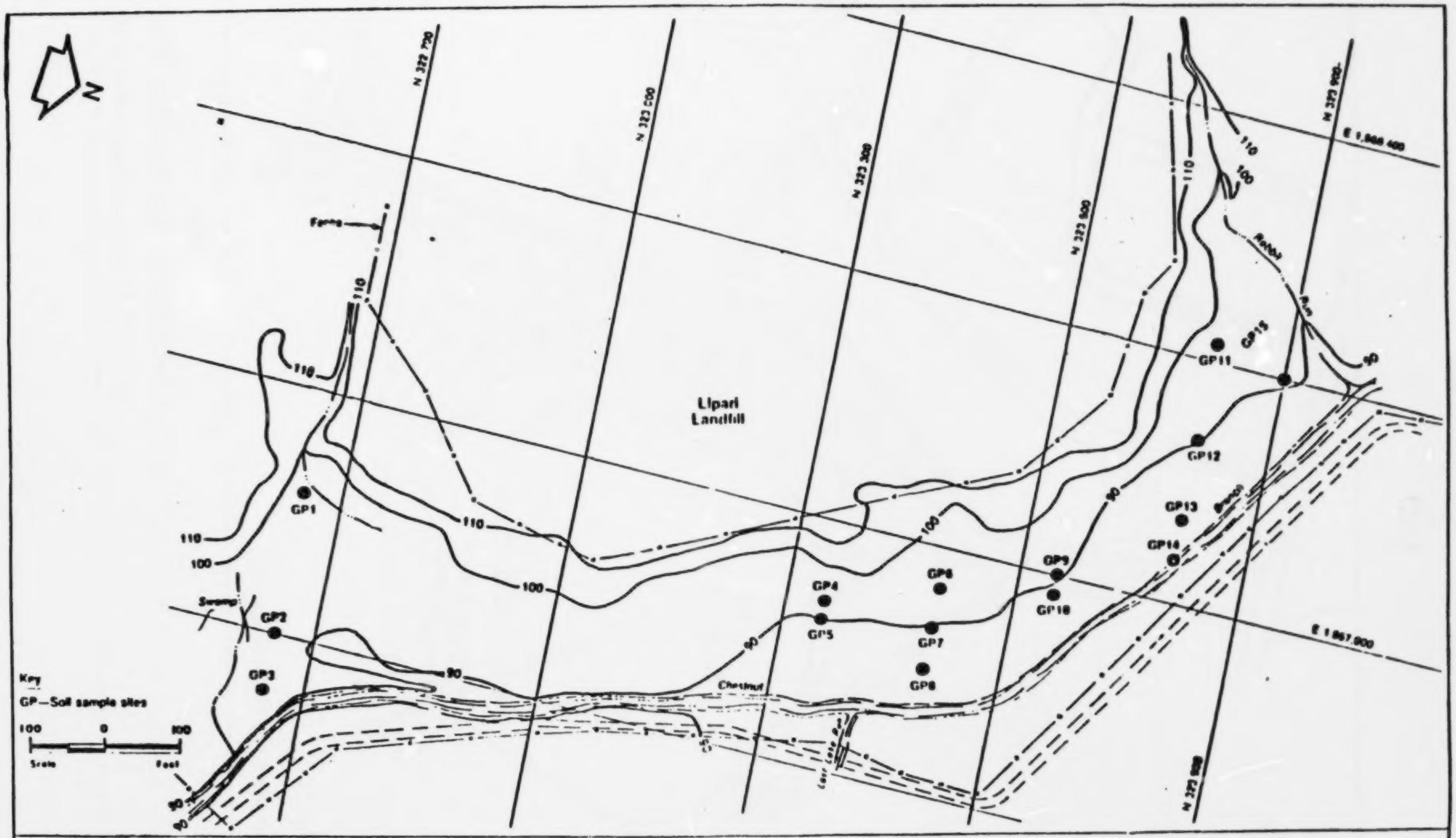

N
C-37
(250' NORTHWEST)
C-38
E 1,856,000
C-36
Slurry Wall
C-39
K-9
K-8
Wood Plank Bridge
E 1,855,500
Gate
K-10
Branch
K-11
K-12
C-33
K-15
C-35
(IN ORCHARD)
E 1,857,000
K-14
C-32
K-13
E 1,857,500
• Existing wells
100 0 100 200
scale feet

Figure 5.8

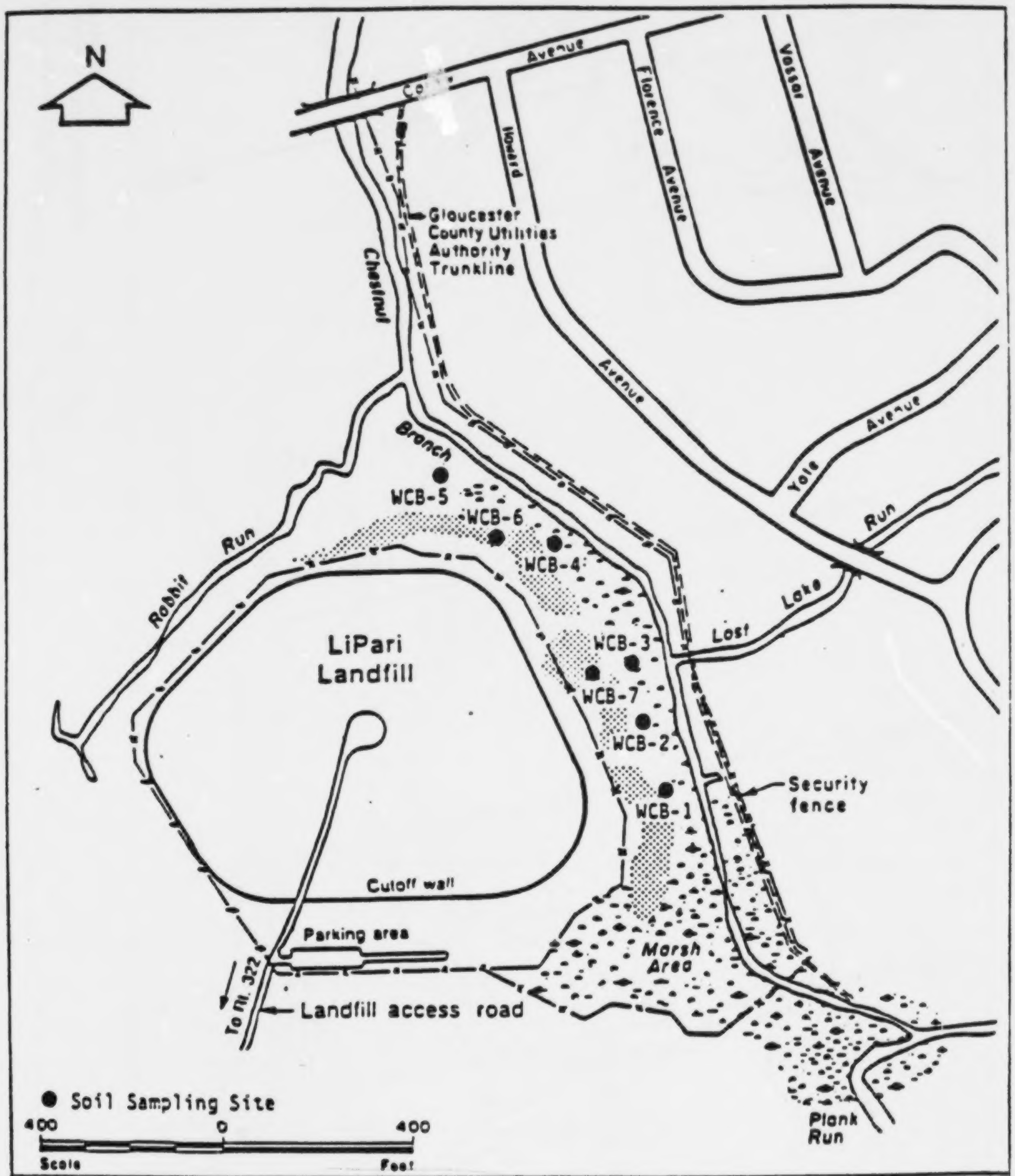
Monitoring Well
Locations

Lipari Landfill, Gloucester County, New Jersey


N
N 322 720
N 323 000
N 323 300
N 323 500
N 323 900
N 323 900
E 1,868,400
E 1,867,000
Lipari Landfill
Ferns
Swamp
Rabbit Run
Chestnut
110
100
90
GP1
GP2
GP3
GP4
GP5
GP6
GP7
GP8
GP9
GP10
GP11
GP12
GP13
GP14
GP15
Key
GP—Soil sample sites
100
0
100
Scale
Feet

Chestnut Branch Marsh
Soil Confirmatory Sample Locations
Lipari Landfill, Gloucester County, New Jersey

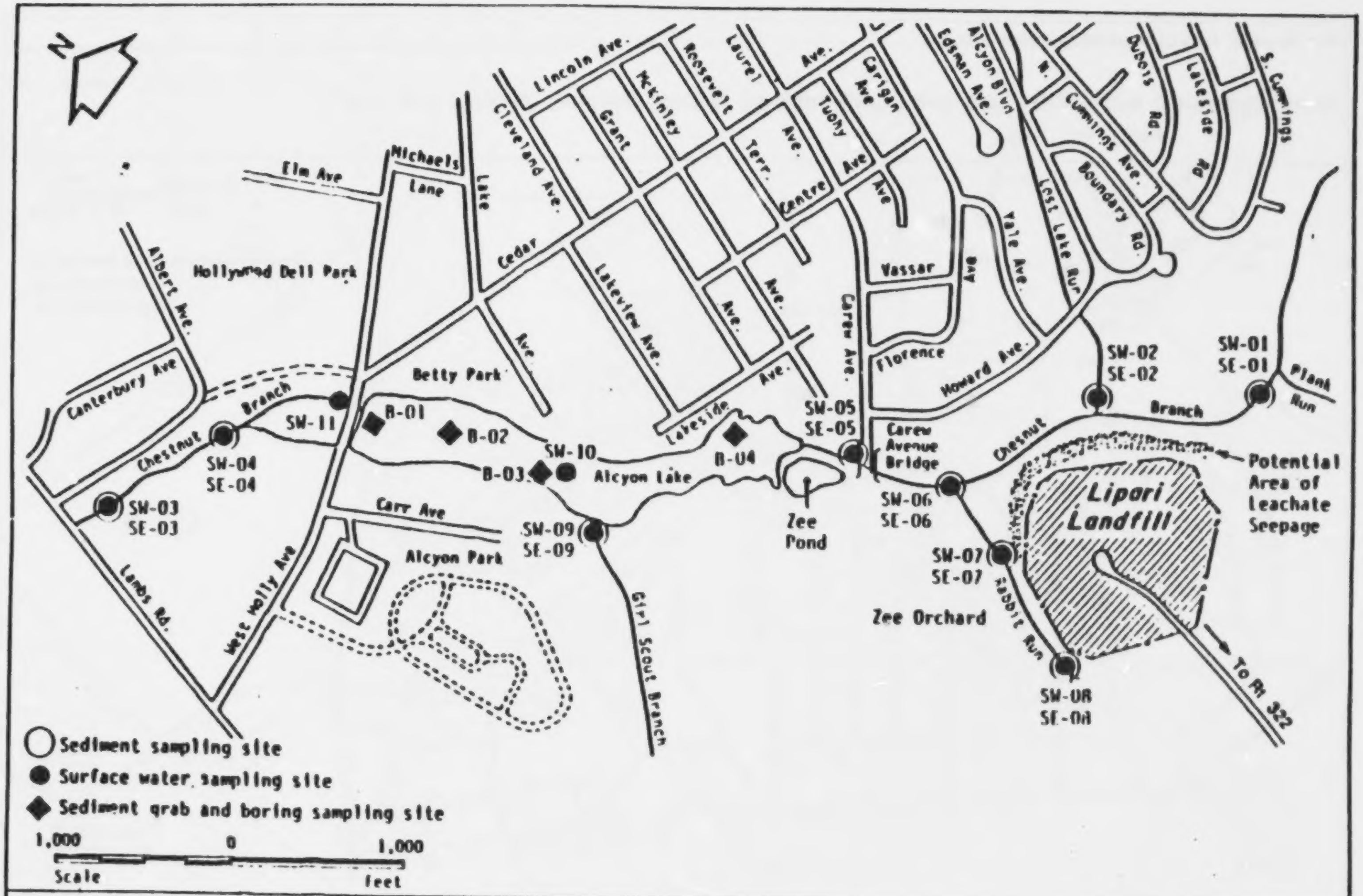
CDM 1985


N
Avenue
Howard
Florence Avenue
Vassar Avenue
Gloucester County Utilities Authority Trunkline
Chestnut
Avenue
Yale Avenue
Branch
WCB-5
WCB-6
WCB-4
Rabbit Run
Run
LiPari Landfill
WCB-3
WCB-7
WCB-2
WCB-1
Lost Lake Run
Security fence
Cutoff wall
Parking area
Marsh Area
To Rt. 322
Landfill access road
● Soil Sampling Site
400
0
400
Scale
Feet
Plank Run

CDM 1985

Chestnut Branch Marsh Soil Sampling Sites

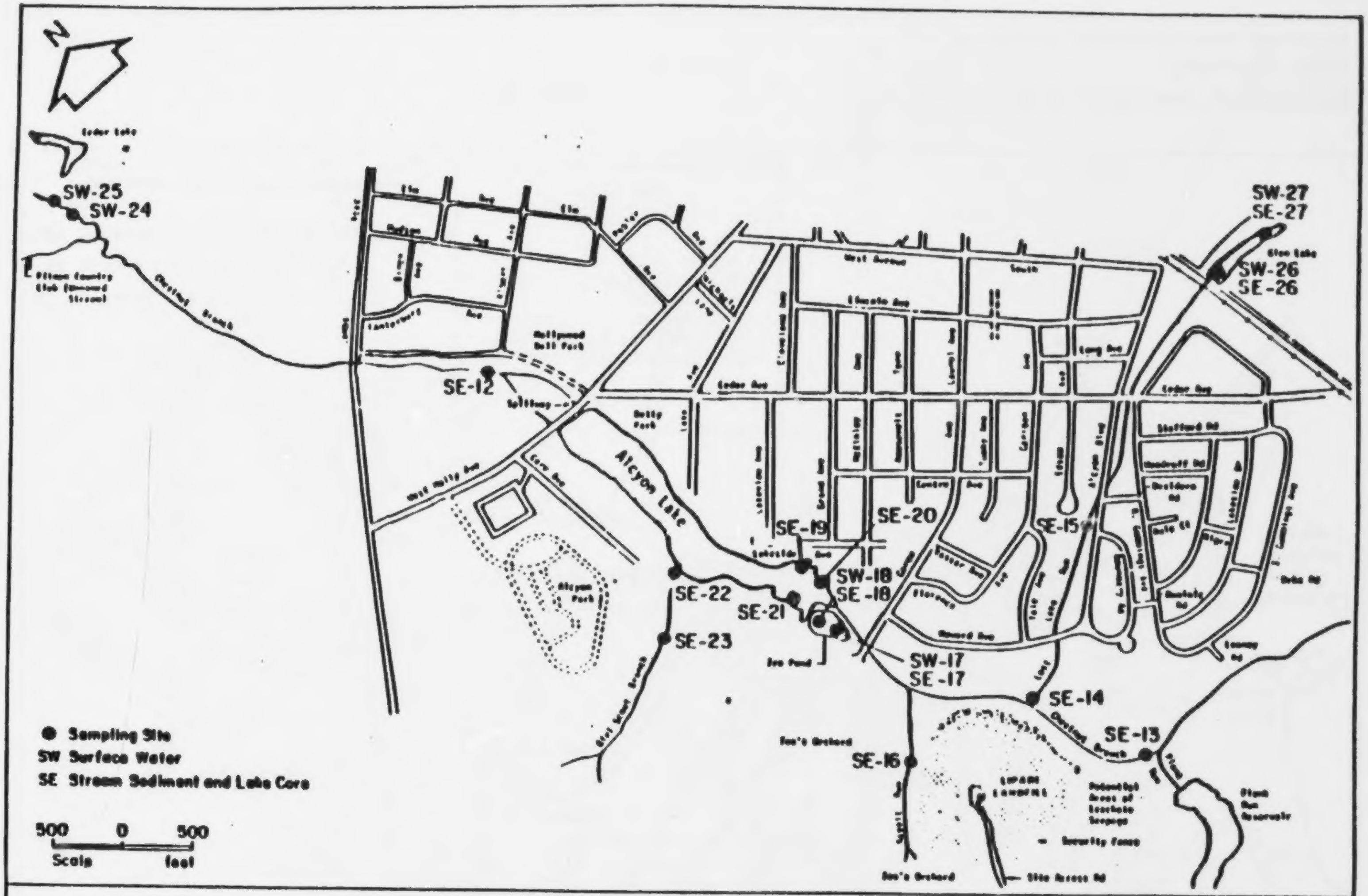
LiPari Landfill, Gloucester County, New Jersey


N
Elm Ave
Michaels Lane
Lake
Cleveland Ave.
Lincoln Ave.
Grant
McKinley
Roosevelt
Laurel
Ave.
Carigan Ave
Tuohy Ave
Terr.
Centre Ave
Ave.
Edsman Ave.
Alcyon Blvd
N.
Cummings Ave.
Dubois Rd.
Lakeside Rd
S. Cummings
Boundary Rd.
Lost Lake Run
Yale Ave.
Bay
Vassar
Carew Ave.
Florence
Howard Ave.
Cedar Ave.
Lakeview Ave.
Ave.
Ave.
Lakeside Ave.
Albert Ave.
Hollywood Dell Park
Canterbury Ave
Betty Park
Chestnut Branch
SW-11
B-01
B-02
SW-10
B-03
Alcyon Lake
B-04
SW-04 SE-04
SW-03 SE-03
Carr Ave
SW-09 SE-09
Alcyon Park
West Holly Ave
Lambs Rd.
Girl Scout Branch
SW-05 SE-05
Carew Avenue Bridge
Zee Pond
SW-06 SE-06
SW-07 SE-07
Zee Orchard
Rabbit Run
SW-08 SE-08
Lipari Landfill
To Rt 322
Potential Area of Leachate Seepage
SW-02 SE-02
SW-01 SE-01
Plant Run
Sediment sampling site
Surface water sampling site
Sediment grab and boring sampling site
1,000
0
1,000
Scale
feet

CDM 1985

Stream Grab and Lake Grab/Boring Sampling Sites

LiPari Landfill, Gloucester County, New Jersey

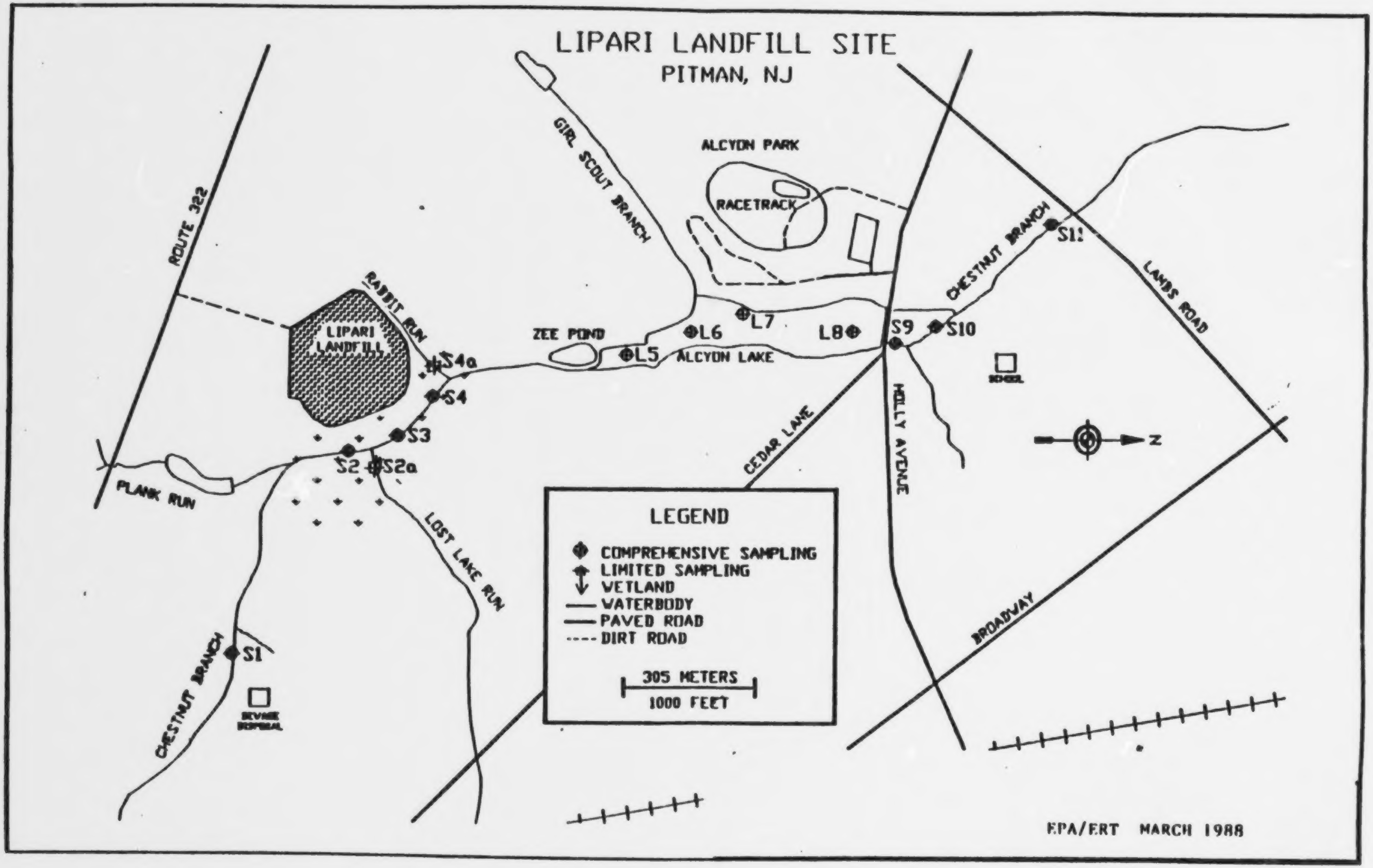

N
Cedar Lake
SW-25
SW-24
Chestnut Branch
SE-12
Alcyon Lake
Alcyon Park
West Avenue
Lincoln Ave
Cedar Ave
Stafford Rd
Woodruff Rd
Glen Lake
SW-27
SE-27
SW-26
SE-26
SE-19
SE-20
SE-15
SW-18
SE-18
SE-21
SE-22
SE-23
SW-17
SE-17
SE-14
SE-13
SE-16
Howard Ave
Bee Pond
Doe's Orchard
Chestnut Branch
LiPari Landfill
Potential Areas of Leachate Seepage
Security Fence
Site Access Rd
● Sampling Site
SW Surface Water
SE Stream Sediment and Lake Core
500 0 500
Scale feet

CDM 1985/1986

Lake and Stream Surface Water, Stream Sediment and Lake Core Sampling Sites

LiPari Landfill, Gloucester County, New Jersey

LIPARI LANDFILL SITE
PITMAN, NJ


ROUTE 322
LIPARI LANDFILL
RABBIT RUN
GIRL SCOUT BRANCH
ALCYON PARK
RACETRACK
ZEE POND
ALCYON LAKE
L5
L6
L7
L8
S1
S2
S2a
S3
S4
S4a
S9
S10
S11
CHESTNUT BRANCH
PLANK RUN
LOST LAKE RUN
CEDAR LANE
HOLLY AVENUE
LAMBS ROAD
BROADWAY
SCHOOL
SEWAGE DISPOSAL
N
LEGEND
COMPREHENSIVE SAMPLING
LIMITED SAMPLING
VETLAND
WATERBODY
PAVED ROAD
DIRT ROAD
305 METERS
1000 FEET
EPA/ERT MARCH 1988

ATTACHMENT C

QUALITATIVE SUMMARY OF COMPOUNDS DETECTED IN THE ON-SITE LIPARI LANDFILL AND IN OFF-SITE AREAS

QUALITATIVE SUMMARY OF COMPOUNDS DETECTED ON-SITE & OFF-SITE LIPARI AREAS

ATILES	ON-SITE		OFF-SITE												
	COHANSEY		CNSY	KWOOD	MARSH			CHNT BR		R RUN		ALCYON			RESIDENTIAL
COMPOUND	SOIL	WAT	WAT	WAT	SOIL	LEA	AIR	SED	WAT	SED	WAT	SED	WAT	AIR	AIR
CHLOROMETHANE						x		x					x		
BROMOMETHANE															
VINYL CHLORIDE		x	x			x									
CHLOROETHANE		x				x					x				
METHYLENE CHLORIDE		x	x	x	x	x		x	x	x	x	x	x		x
ACETONE	x	x		x	x	x	x	x	x	x	x	x	x	x	x
CARBON DISULFIDE	x				x	x						x			
1,1-DICHLOROETHENE						x	x								x
1,1-DICHLOROETHANE		x	x	x	x	x	x				x				x
1,2-DICHLOROETHENE	x	x	x	x	x	x									
CHLOROFORM	x	x	x	x		x									
1,2-DICHLOROETHANE	x	x	x	x		x	x								x
2-BUTANONE	x	x		x		x		x	x		x	x			
1,1,1-TRICHLOROETHANE	x	x		x			x	x	x	x			x	x	x
CARBON TETRACHLORIDE						x	x								
VINYL ACETATE															
BROMODICHLOROMETHANE		x	x	x											
1,2-DICHLOROPROPENE	x		x												
cis-1,3-DICHLOROPROPENE		x													
TRICHLOROETHENE	x	x	x		x	x	x		x					x	x
DIBROMOCHLOROMETHANE															
1,1,2-TRICHLOROETHANE	x		x				x								x
BENZENE	x	x	x	x	x	x	x	x	x	x	x	x	x		x
ns-1,3-TRICHLOROETHANE													x		
OMOFORM			x												
4-METHYL-2-PENTANONE	x	x	x	x	x	x						x			
2-HEXANONE	x	x				x	x							x	x
TETRACHLOROETHENE	x	x	x		x										
1,1,2,2-TERTRACHLOROETHENE															
TOLUENE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CHLOROBENZENE	x	x	x		x	x	x								
ETHYLBENZENE	x	x	x	x	x	x	x	x			x			x	x
STYRENE	x	x	x				x				x				
XYLENES	x	x	x	x	x	x	x	x					x	x	
2-CHLOROETHYL VINYL ETHER	x														
C_3ALKYL BENZENE							x							x	x
C_6ALKANE							x								
C_7ALKANE							x								
C_8ALKANE							x							x	
FREON-12															
1,4-DIOXANE							x								x

KEY:

CNSY- Cohansey Aquifer
KWOOD-Kirkwood Aquifer
MARSH-Chestnut Branch Marsh

R RUN-Rabbit Run
ALCYON-Alcyon Lake
CHNT BR-Chestnut branch stream
WAT-Water sample

LEA-Leachate sample
AIR-Air sample

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QUALITATIVE SUMMARY OF COMPOUNDS DETECTED ON-SITE & OFF-SITE LIPARI AREAS

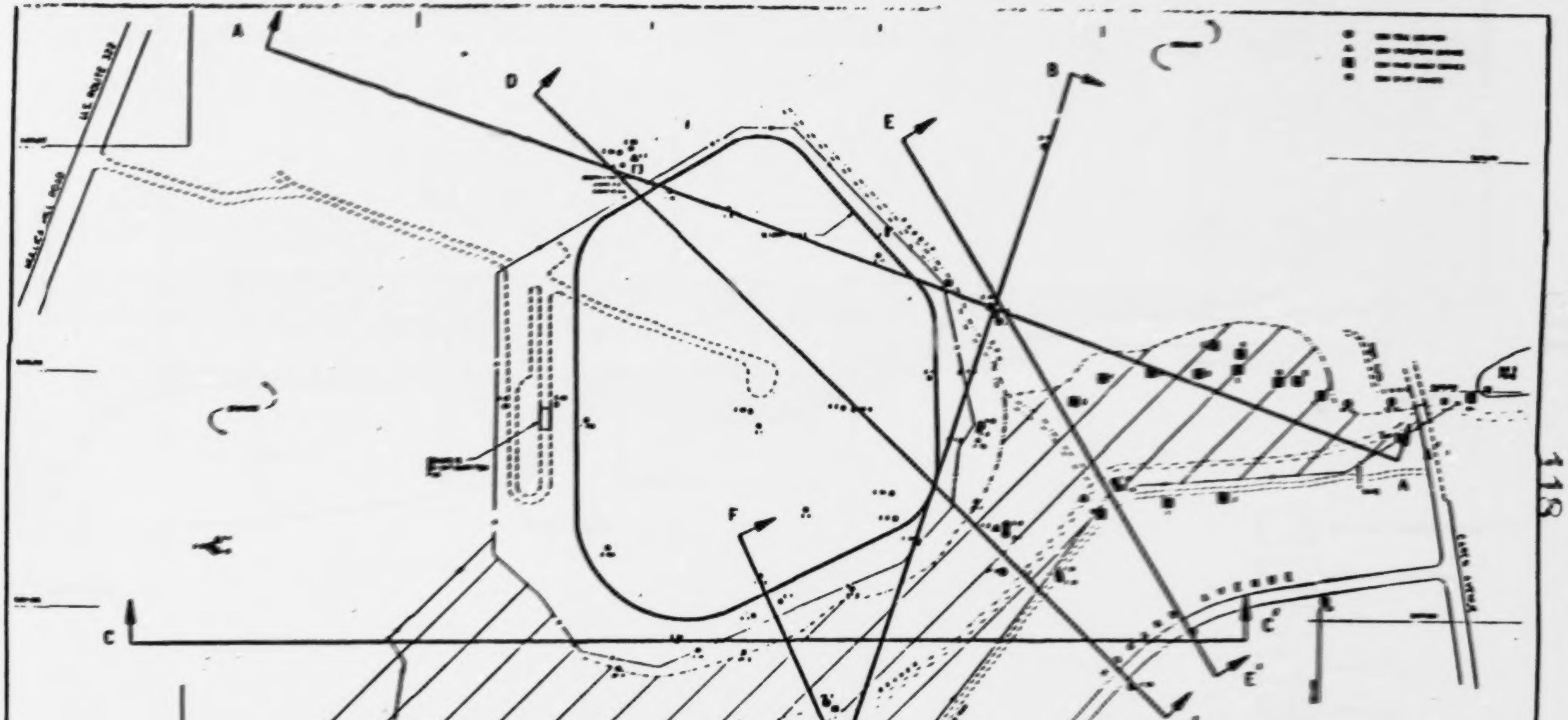
SEMI-VOLATILES	ON-SITE		OFF-SITE												
	COHANSEY		CNSY	KWOOD	MARSH			CHNT	BR	R	RUN	ALCYON			RESIDE
COMPOUND	SOIL	WAT	WAT	WAT	SOIL	LEA	AIR	SED	WAT	SED	WAT	SED	WAT	AIR	AIR
PHENOL	x	x	x	x		x	x				x		x		
bis (2-CHLOROETHYL)ETHER	x	x	x	x	x	x	x	x	x	x	x	x	x		x
2-CHLOROPHENOL	x														
1,3-DICHLOROBENZENE	x				x										
1,4-DICHLOROBENZENE	x	x	x												
BENZYL ALCOHOL	x	x				x									
1,2-DICHLOROBENZENE	x	x	x		x	x									
2-METHYL PHENOL	x	x				x						x			
bis (2-CHLOROISOPROPYL)ETHER	x														
4-METHYL PHENOL	x	x				x				x		x			
N-NITROSO-DI-N-PROPYLAMINE	x														
HEXACHLOROETHANE															
NITROBENZENE															
ISOPHORONE	x				x	x									
2-NITROPHENOL															
2,4-DIMETHYL PHENOL	x					x			x						
BENZOIC ACID	x	x			x	x		x	x	x	x				
bis (2-CHLOROETHOXY)ETHANE		x	x	x	x	x			x	x	x		x		
2,4-DICHLOROPHENOL		x													
1,2,4-TRICHLOROBENZENE	x														
NAPHTHALENE	x	x	x		x	x	x	x		x	x	x			
4-CHLOROANILINE	x	x				x									
HEXACHLOROBUTADIENE															
4-CHLORO-3-METHYL PHENOL	x														
2-METHYL NAPHTHALENE	x	x			x	x		x							
HEXACHLOROCYCLOPENTADIENE															
2,4,6-TRICHLOROPHENOL	x			x											
2,4,5-TRICHLOROPHENOL															
2-CHLORONAPHTHALENE	x														
2-NITROANALINE															
DIMETHYL PHTHALATE	x														
ACENAPHTHALENE	x	x			x										
3-NITROANALINE															
ACENAPHTHENE					x			x	x	x		x			
2,4-DINITROPHENOL	x														
4-NITROPHENOL	x									x					
DIBENZOFURAN	x				x										
2,4-DINITROTOLUENE	x														
2,6-DINITROTOLUENE															
DIETHYL PHTHALATE	x	x	x			x		x		x					
4-CHLOROPHENYL-PHENYLETHER															
FLOURENE	x				x					x		x			
4-NITROANILINE															
4,6-DINITRO-2-METHYLPHENOL															
N-NITROSODIPHENYLAMINE	x				x					x					
4-BROMOPHENYL-PHENYLETHER															
HEXACHLOROBENZENE		x			x										
PENTACHLOROPHENOL	x														
PHENANTHRENE	x				x			x		x		x			
ANTHRACENE	x							x		x		x			

QUALITATIVE SUMMARY OF COMPOUNDS DETECTED ON-SITE & OFF-SITE LIPARI AREAS

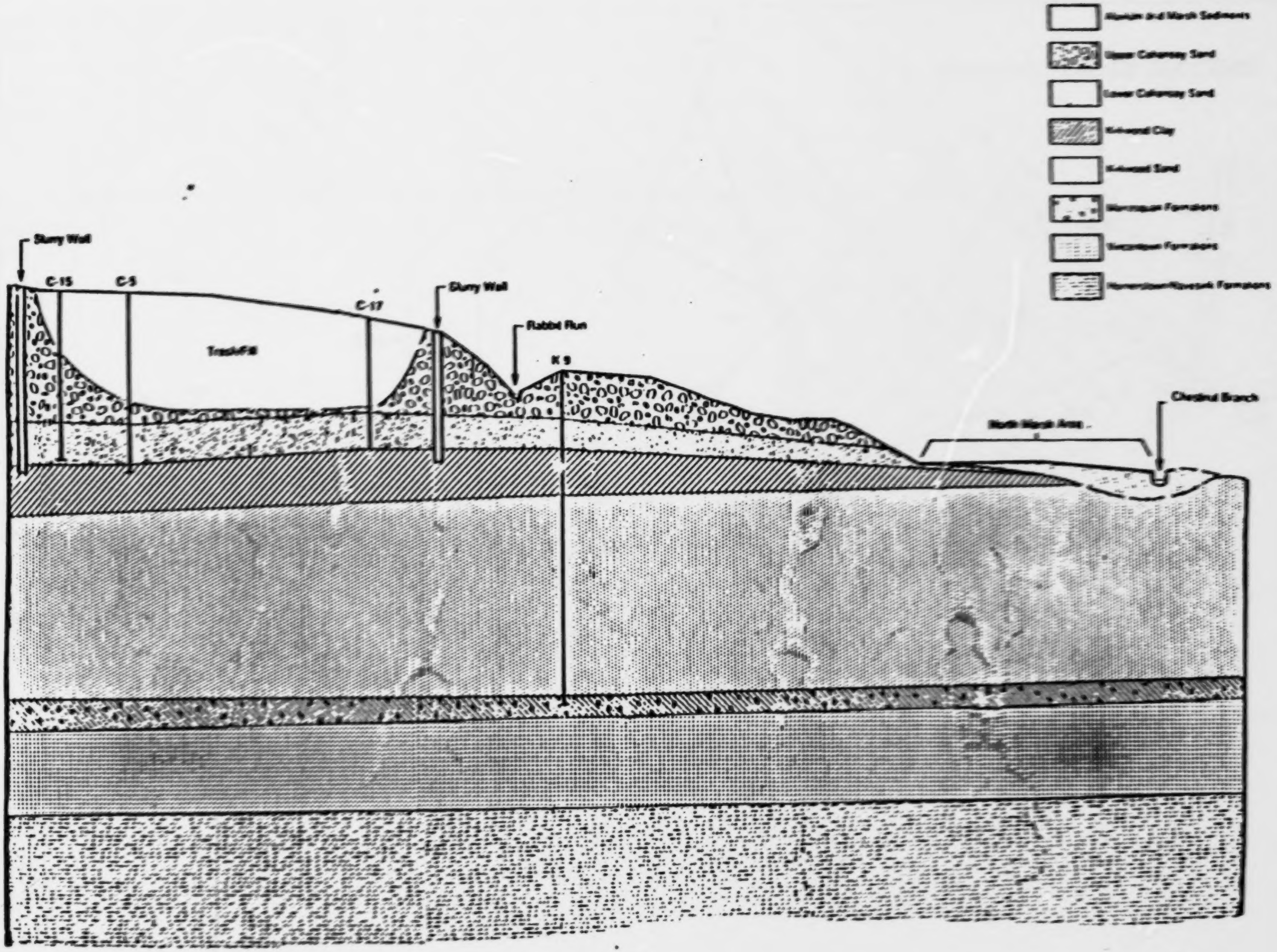
SEMI-VOLATILES	ON-SITE		OFF-SITE												
	COHANSEY		CNSY	KWOOD	MARSH			CHNT	BR	R	RUN	ALCYON			RESIDENTIAL
COMPOUND	SOIL	WAT	WAT	WAT	SOIL	LEA	AIR	SED	WAT	SED	WAT	SED	WAT	AIR	AIR
DI-N-BUTYL PHTHALATE	x	x	x		x	x		x	x	x	x	x	x		
FLOURANTHENE	x				x	x		x	x	x		x			
PYRENE	x				x	x		x		x		x			
BUTYLBENZYL PHTHALATE	x	x		x				x			x				
3,3'-DICHLOROBENZENE															
BENZO(a)ANTHRACENE	x				x			x		x		x			
BIS(2-ETHYLHEXYL)PHTHALATE	x		x	x	x	x		x	x	x	x	x	x		
CHRYSENE	x				x			x	x	x		x			
DI-N-OCTYL PHTHALATE	x			x	x	x		x				x			
BENZO(b)FLOURANTHENE	x				x			x				x			
BENZO(k)FLOURANTHENE	x				x			x				x			
BENZO(a)PYRENE	x	x						x		x		x			
INDENO(1,2,3-cd)PYRENE					x			x				x			
DIBENZO(a,h)ANTHRACENE												x			
BENZO(g,h,i)PERYLENE					x			x				x			
INORGANIC															
ARSENIC	x	x	x	x	x	x		x			x	x	x		
BARIUM	x	x	x	x	x			x	x		x	x	x		
BERYLLIUM	x		x	x		x		x		x	x	x	x		
CADMIUM	x	x	x	x	x	x		x	x	x	x	x	x		
CHROMIUM	x	x	x	x	x	x		x	x	x	x	x	x		
COPPER	x	x	x	x	x	x		x	x	x	x	x	x		
LEAD	x	x	x	x	x	x		x	x	x	x	x	x		
MERCURY	x	x	x	x	x	x		x		x	x	x	x		
NICKEL	x	x	x	x	x	x		x	x	x	x	x	x		
SELENIUM		x	x	x				x	x		x	x	x		
SILVER	x	x	x	x		x			x		x	x	x		
THALLIUM			x	x				x							
VANADIUM	x	x	x	x	x	x		x	x	x	x	x	x		
ZINC	x	x	x	x	x	x		x	x	x	x	x	x		

ATTACHMENT D

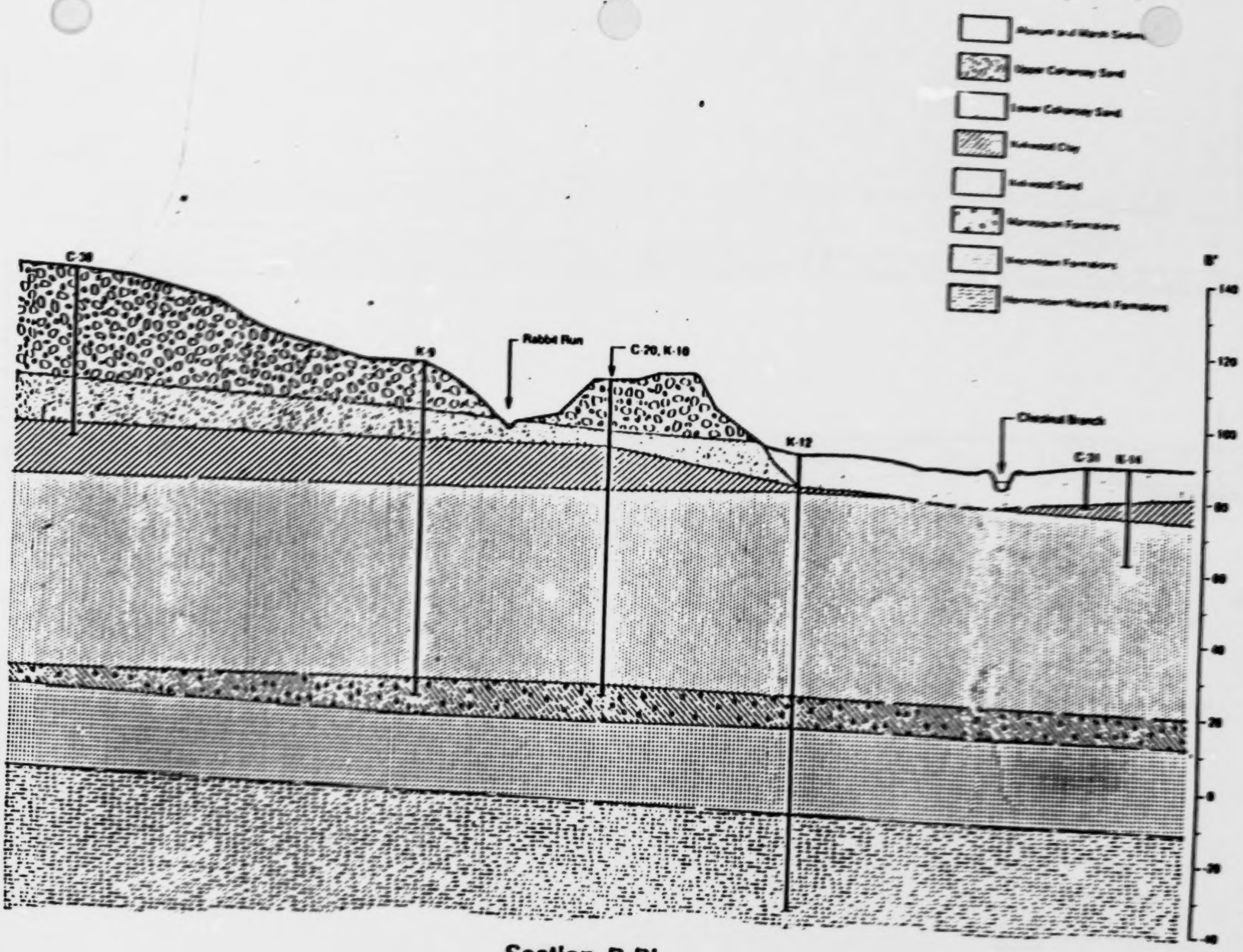
GEOLOGIC PROFILES


A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
U.S. ROUTE 322

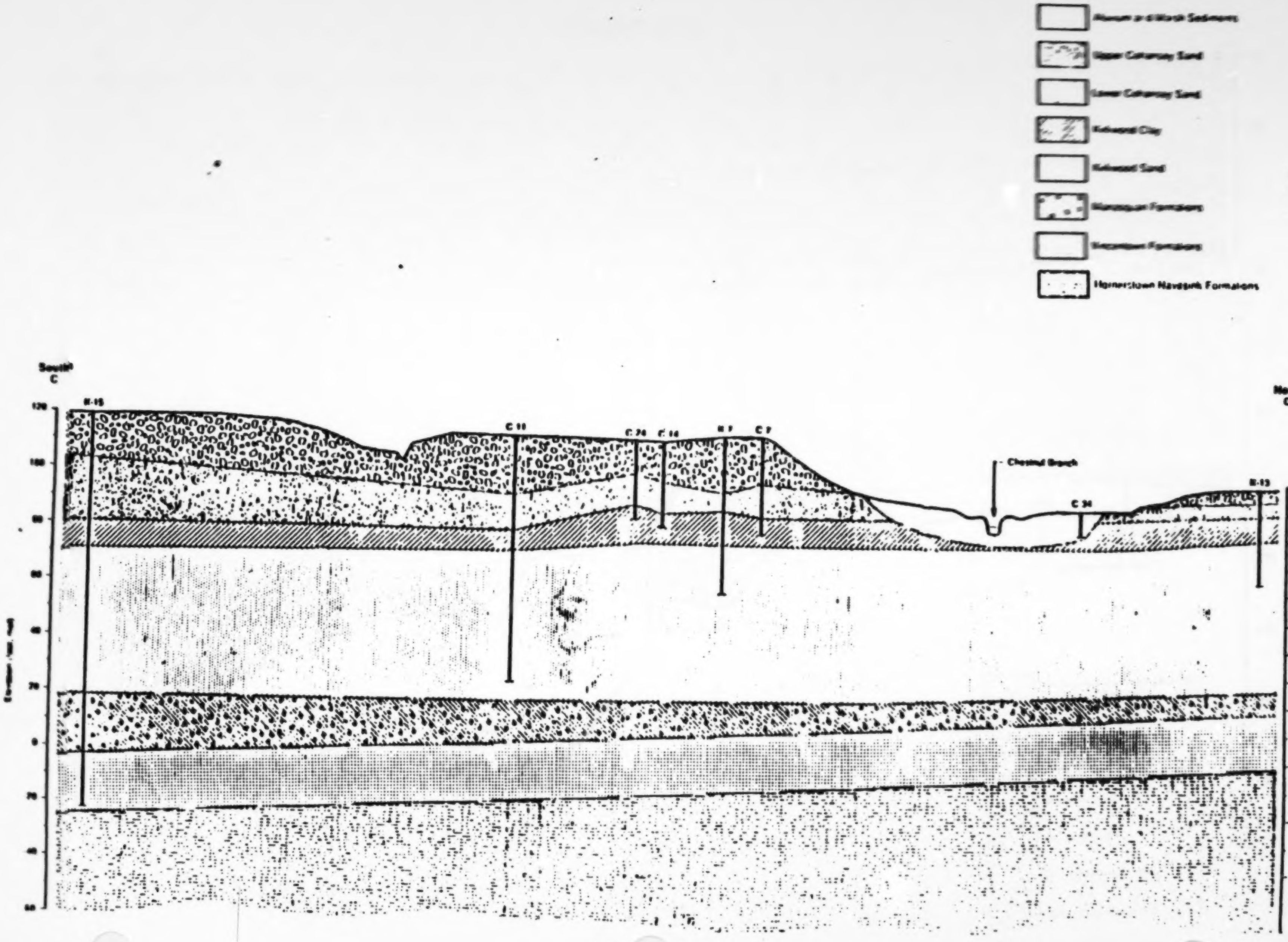
GEOLOGIC CROSS SECTIONS


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formations
Vincentown Formations
Hornerstown/Navesink Formations
Slurry Wall
C-15
C-5
Trash/Fill
C-17
Slurry Wall
Rabbit Run
K 9
North Marsh Area
Chestnut Branch

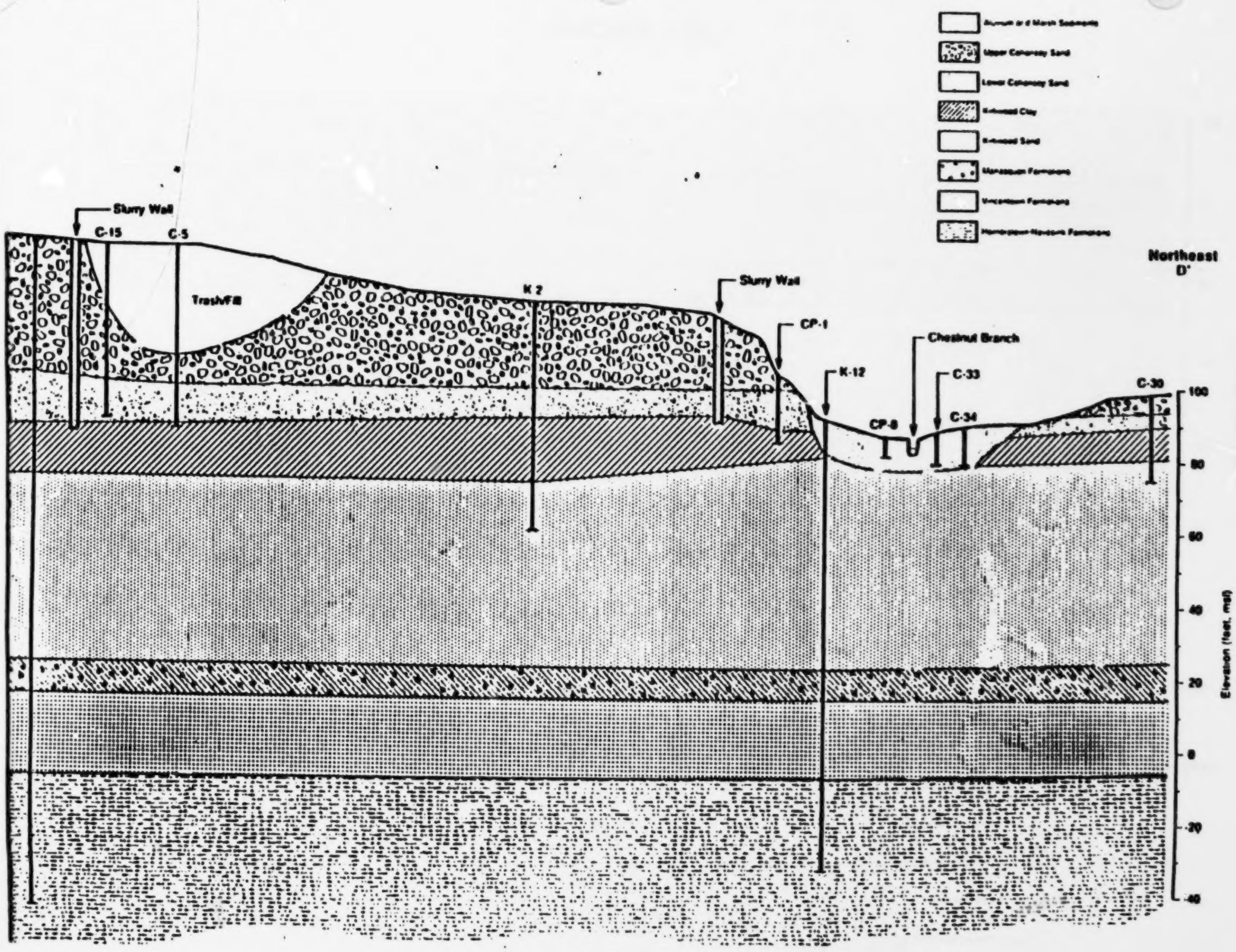
Section A-A'


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formation
Vincentown Formation
Hornerstown/Navesink Formation
B'
140
120
100
80
60
40
20
0
-20
-40
C-38
K-9
Rabbit Run
C-20, K-10
K-12
Chestnut Branch
C-31
K-14

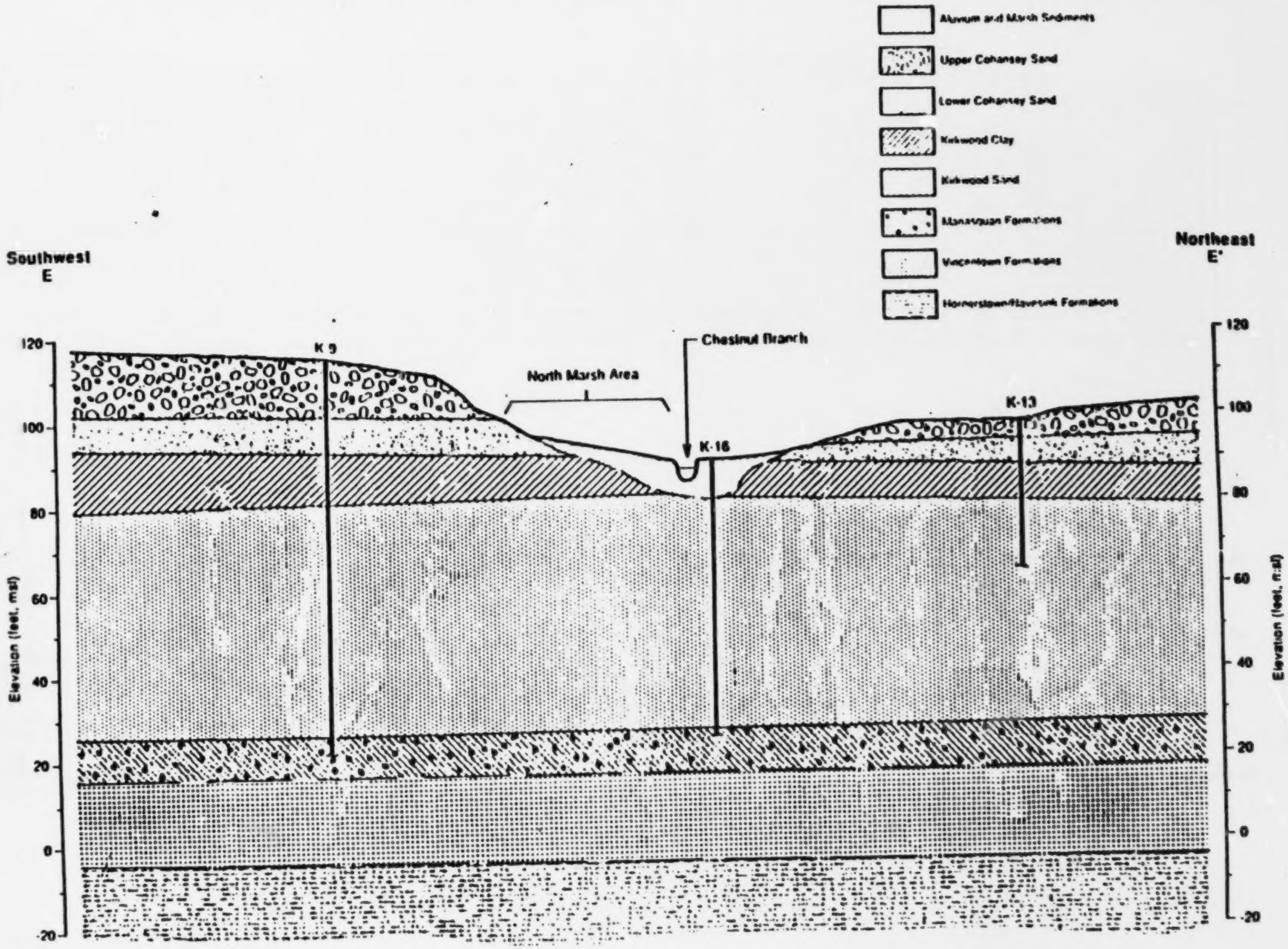
Section B-B'


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formation
Vincentown Formation
Hornerstown Navesink Formations
South
C
North
C'
H-15
C 11
C 24
C 14
H 7
C 7
Chestnut Branch
C 34
H-13
120
100
80
60
40
20
0
-20
-40
-60

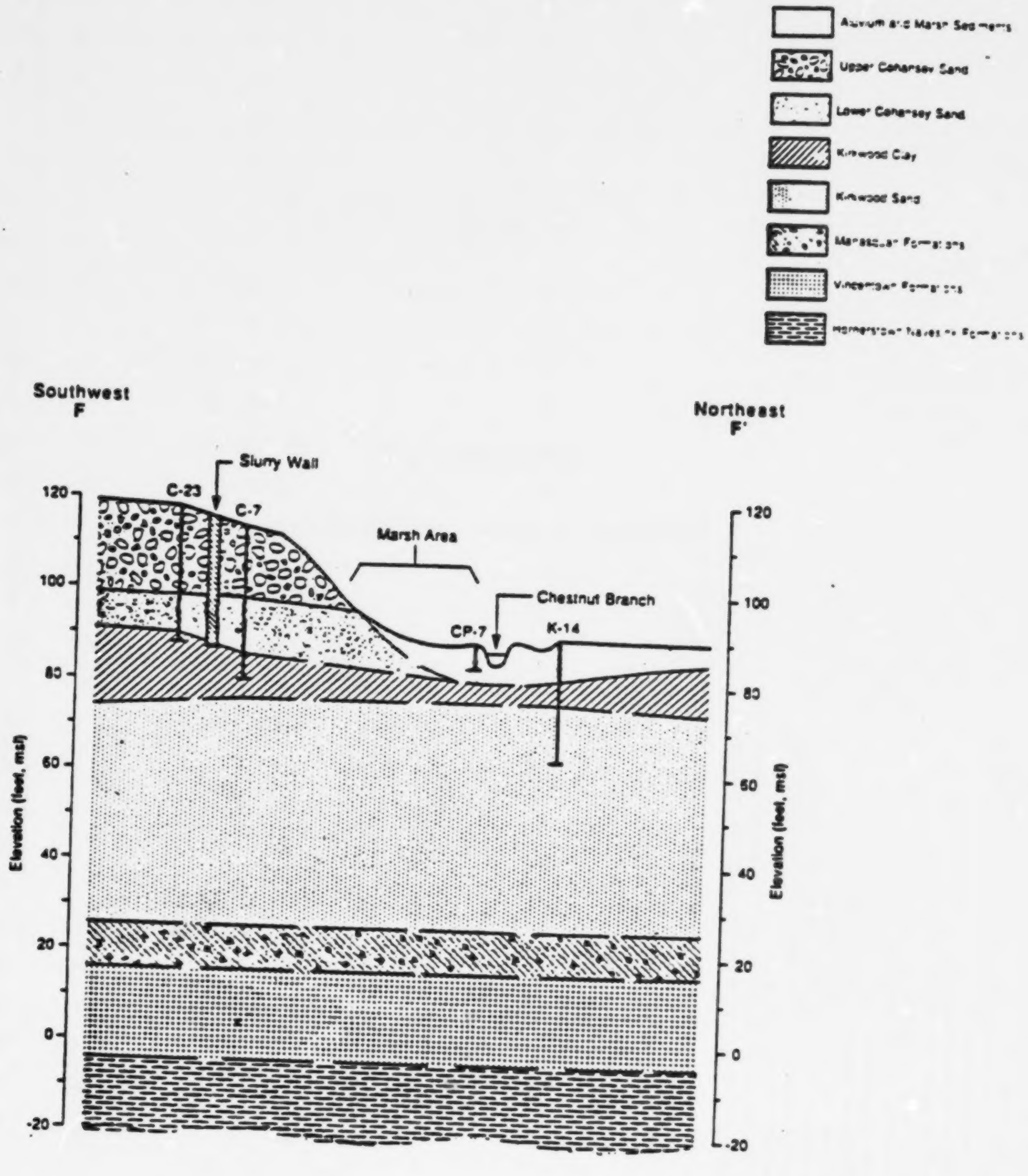
Secti C-C'


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formation
Vincentown Formation
Hornerstown-Navesink Formation
Northeast
D'
Slurry Wall
C-15
C-5
Trash/Fill
K 2
Slurry Wall
CP-1
K-12
CP-8
Chestnut Branch
C-33
C-34
C-30
100
80
60
40
20
0
-20
-40
Elevation (feet, msl)

[illegible]


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formations
Vincentown Formations
Hornerstown/Navesink Formations
Southwest
E
Northeast
E'
K-9
North Marsh Area
Chestnut Branch
K-16
K-13
120
100
80
60
40
20
0
-20
Elevation (feet, msl)

Section E-E'


Alluvium and Marsh Sediments
Upper Cohansey Sand
Lower Cohansey Sand
Kirkwood Clay
Kirkwood Sand
Manasquan Formations
Vincentown Formations
Hornerstown Navesink Formations
Southwest
F
Northeast
F'
Slurry Wall
C-23
C-7
Marsh Area
Chestnut Branch
CP-7
K-14
120
100
80
60
40
20
0
-20
Elevation (feet, msl)

Section F-F'

ATTACHMENT E

PROPOSED REMEDIAL ACTION PLAN

Summary of Compounds Tentatively Identified by TAGA During Spectral
Analysis of Spring Leachate, Headspace, and Vent Samples.

	Sample Locations (1)																				Sample Locations (		NJYG	NJYG	NJYG	NJYG					
Compound	Z1L1	Z1L2	Z1L3	Z1L4	Z1L5	Z2L1	Z2L2	Z2L3	Z2L4	Z2L5	Z3L1	Z3L2	Z3L3	Z4L1	Z4L2	Z4L3	Z5L1	Z5L2	Z5L3	Z6L1	Z6L2	Z6L3	SW1	SW2	SW3	SW4	V1	V2	V3	V4	V5
Di-N-propylamine	X																														
Acetone		X	X		X		X				X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Ethyl Benzene/xylenes	X	X	X	X		X	X	X	X					X	X	X	X		X	X	X										
Methyl Isobutyl Ketone	X		X				X																								
2-Methyl-1-butanol	X																														
Propylene glycol	X																														
Acrylamide	X																														
Dichloroethane	X		X																												
Bis-(2-chloroethyl) ether	X	X	X	X		X	X	X	X		X		[illegible]	X	X	X	X	X		X	X	X			X						
Acrolein		X																													
Propanols		X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Benzene		X	X			X	X	X	X								X	X	X		X										
Toluene		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X					
C4 Alkyl Aromatics (1)		X				X									X	X															
C3 Alkyl Aromatics (2)		X	X	X		X		X	X					X	X	X	X														
2-Heptanone		X					X									X															
Benzyl alcohol				X																											
Ethylene glycol				X			X	X	X	X	X	X			X		X	X	X	X	X	X									
Diethyl ether							X																								
Carbon Tetrachloride								X			X			X					X	X		X									
C8 Hydrocarbons (3)				X				X		X	X								X												
C7 Hydrocarbons (3)									X	X	X																				
C9 Hydrocarbons (3)									X	X		X																			
C10 Hydrocarbons (3)									X																						
C5 Aldehyde or Ketone										X																					
Picoline/Phenol (4)				X	X					X				X			X		X	X	X	X	X	X		X				X	X
Butanol													X																		
C6 Hydrocarbon (3)													X	X									X								
Dimethyl Benzaldehyde (5)														X																	
C5 Nitrile (6)															X																
C7 Oxygenated hydrocarbon (7)			X												X																
Styrene (Ethylene benzene)				X													X				X										
Chlorobenzene																	X	X													

Notes:

(1) C4 Alkyl Aromatics refers to any compound with 4 carbons substituted onto a benzene ring regardless of the degree of unsaturation of the side chains. (Ex. butyl benzene)

(2) C3 Alkyl Aromatics refers to any compound with 3 carbons substituted onto a benzene ring regardless of the degree of unsaturation of the side chains. (Ex. isopropyl benzene & 2-propenyl benzene)

(3) C8 hydrocarbons refers to any non-substituted hydrocarbon with 8 carbons in its structure. Includes both alkanes and alkenes.

(4) Picoline/phenol refers to an unknown which fragments similar to picoline, phenol, or methyl pyridine. The TAGA cannot easily distinguish between these compounds in dirty samples.

(5) Dimethyl benzaldehyde may be formed in the source by a excess of of xylenes and the water vapor.

(6) C5 nitrile refers to "2-Methylene-Butanenitrile or 2-Pentenenitrile". The TAGA is unable to define the exact hydrocarbon structure and degree of unsaturation of the original compound in this sample.

(7) C7 Oxygenated hydrocarbon also includes Oxygenated cycloheptane

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CONTAMINANTS TENTATIVELY IDENTIFIED BY TAGA DURING SPECTRAL ANALYSIS OF LEACHATE AND LAKE SURFACE HEADSPACE SAMPLES AND AIR VENT GRAB SAMPLES
SEPTEMBER 1986

Compound	Sample Locations (1)																							
	Z1L1	Z1L2	Z1L3	Z2L1	Z2L2	Z2L3	Z3L1	Z3L2	Z3L3	Z4L1	Z4L2	Z4L3	Z5L1	Z5L2	Z5L3	Z6L1	Z6L2	Z6L3	SW1	SW2	SW3	V2	V3	V5
Acetone	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Propanol	x			x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Bis-(2-chloroethyl) ether	x	x	x		x	x				x	x	x	x	x	x	x								
Methyl Isobutyl Ketone	x				x					x														
C5 Oxygenated Hydrocarbon				x																				
C6 Hydrocarbons	x									x														
Carbon Tetrachloride		x	x	x		x	x	x			x	x	x	x		x	x		x	x	x			
Ethylene Glycol			x		x				x	x	x	x		x	x	x								x
Benzene	x				x	x				x	x		x	x	x	x								
Toluene	x		x		x					x	x			x		x								
1,2-Dichloroethane (2)					x																			
C2 Alkyl Aromatics					x					x	x			x			x							
1,4-Dioxane						x																		
1,1,1-Trichloroethane								x				x												
Chlorobenzene													x	x		x								
C3 Alkyl Aromatics										x							x							
Picoline/Phenol										x												x	x	
Cresol										x														
1,1-Dichloroethene																x								
C7 Hydrocarbons																								x

Notes

(1) Naming system used for leachate samples ZiLj refers to Zone i Lea J. SW, refers to surface water sample number, Vi refers to Vent Number i Air Bag

(2) 1,2 dichloroethane/vinyl chloride identical spectra on the TAGA

(3) SW4 not reported in Enviresponse report (Enviresponse 1987c)

(4) The following target contaminants were analyzed for but were not detected

1,1 Dichloroethane	Tetrachloroethene
Dichloromethane (Methylene Chloride)	1,1,2 Trichloroethane
Freon 12	Trichloroethene